Measuring the Quality of Pennsylvania's HMOs

A MANAGED CARE PERFORMANCE REPORT

FISCAL YEAR 1999

TECHNICAL REPORT

THE PENNSYLVANIA HEALTH CARE COST CONTAINMENT COUNCIL

July 2000

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FOREWORD

The Council wishes to thank…

Throughout this study, the Pennsylvania Health Care Cost Containment Council (PHC4) made decisions in conjunction with its Technical Advisory Group (a standing committee charged with overseeing all technical and methodological aspects of the Council's research). The Council's Payor Advisory Group provided special guidance on matters relating to the payor data included in the *Measuring the Quality of Pennsylvania's HMOs – A Managed Care Performance Report*. We appreciate the interest that these groups have shown in this study and are grateful for their advice.

The Council also wishes to thank the Insurance Federation of Pennsylvania and the Managed Care Association of Pennsylvania for their assistance and support throughout this process.

A special thank you is extended to the Council's Data Systems Committee, individuals who reviewed drafts, the clinical advisors at hospitals who took the time to personally advise Council staff of case selection, and William J. West, MD for his advice regarding hysterectomy.

Lastly, the Council wishes to acknowledge the efforts of hospital and HMO staff who checked and rechecked the data included in this study.

As we strive toward the goal of quality, cost-effective health care, as directed by managed care networks, we truly appreciate the efforts that these individuals and groups committed to this project.

Copies of *Measuring the Quality of Pennsylvania's HMOs - A Managed Care Performance Report* and this document, the *Technical Report*, can be obtained by contacting the Council, or can be accessed electronically via the Council's Web site, http://www.phc4.org.

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TECHNICAL REPORT
MEASURING THE QUALITY OF PENNSYLVANIA'S HMOS - FY'99 MANAGED CARE PERFORMANCE REPORT

OVERVIEW

This technical supplement accompanies the FY99 version of *Measuring the Quality of Pennsylvania's HMOs—A Managed Care Performance Report* (hereafter referred to as the *Managed Care Performance Report*). Included in this *Technical Report* are detailed descriptions of sources of data, explanation of adjustments to the data, and presentation of the methodology for the risk adjustment and final analyses of the clinical outcomes data.

The *Managed Care Performance Report* provides information related to the quality of health care services received by those members and patients belonging to commercial Health Maintenance Organizations licensed to do business in Pennsylvania. The report brings together information from several sources into one reference, allowing purchasers, consumers, payors, and providers to make comparisons among HMOs based upon a comprehensive set of data. Information included in the analyses were obtained from Pennsylvania's acute care hospitals, the National Committee for Quality Assurance, the Pennsylvania Department of Health, and the Pennsylvania Insurance Department.

Most of the content of the *Technical Report* describes calculation of the outcome measures found in the *Managed Care Performance Report*. A detailed explanation follows for data collection and verification procedures, selection of clinical conditions and outcomes for study, and building of episodes of care.

Outcome measures are specific to the four clinical conditions/treatments included in the main report: asthma (separate pediatric and adult analyses), heart attack (referred to as acute myocardial infarction or AMI throughout this document), heart failure, and elective (non-malignant/non-emergent) hysterectomy (abdominal and vaginal reported separately). This *Technical Report* presents the methodology for age/sex adjustment for hospitalization rates, the risk adjustment of length of stay, in-hospital mortality rates, average number of days hospitalized, in-hospital complication rate, and readmission rate. The methodology developed to calculate expected and observed condition/treatment outcome rates and their associated statistical tests is also outlined.

It is important to note that the research methodology yielding outcome ratings is complex and differs for each of the four clinical conditions/treatments. The development of methodologies was based upon state-of-the-art practices determined by a current review of the medical outcome literature, discussions with practicing medical professionals, and careful review and approval by the Council's Technical Advisory Group. Each clinical condition/treatment was selected using a set of criteria that represented health issues of most importance to purchasers and consumers, importance of the clinical condition ranked by risk and cost factors, and expectation that these specific conditions are manageable by an HMO.

Much attention in the following text is focused upon appropriate ways to measure care that has been managed by an HMO. Often, this management is on-going or is provided over a period of time. Clinical outcomes, it follows, result from a series of encounters and types of care. This coordination and facilitation of medical treatment is the foundation of managed care. Therefore, the methodology used to measure outcomes and to compare outcomes across HMOs is based upon medical episodes (strings of events) rather than single encounters with doctors and hospitals. Thus, the evaluation of outcomes follows the type of care provided by HMOs.

Sources and descriptions of financial indicators, ratings of HMOs by members, and other descriptive measures and HMO characteristics are also included in this report.

REFERENCE DATABASE

The Pennsylvania reference database for each of the four clinical conditions (see below) is comprised of cases who(se):

- age is under 65 years
- met the clinical inclusion criteria for the condition being investigated.
- were discharged from a Pennsylvania *acute care* hospital between July 1, 1998 to June 30, 1999.

Only inpatient acute care hospitalizations occurring in an acute care facility were analyzed for this report (i.e., cases for skilled nursing, rehabilitation, ambulatory surgery, and psychiatric facilities were not included). Using acute care hospitalizations from the PA reference database as outlined above, outcome data are analyzed and reported (displayed) on:

- the 18 largest commercial HMOs licensed in Pennsylvania.
- the commercial HMO aggregate (data are displayed as the HMO totals and/or average).
- a commercial "traditional fee-for-service" group (i.e., only patients who are clearly identified in a hospital record as a member of a major traditional fee-for-service plan). Note: the hospitalization rates per member are not reported for this group due to data unavailability.

Outcome data from hospitalizations not included in any of the above three categories (i.e., cases not clearly identified as traditional fee-for-service, cases insured through Medicaid or Medicare and under age 65, or cases that are self-insured or uninsured) are not displayed independently in this report. These hospitalizations are categorized into a group named "other". Outcome data from these hospitalizations are used, however, in the statewide average calculations shown in this *Technical Report*.

DATA COLLECTION AND VERIFICATION

The data utilized in the *Managed Care Performance Report* were obtained from several sources including: (1) PA acute care hospitals, (2) the National Committee for Quality Assurance (NCQA), (3) the PA Department of Health, and (4) the PA Insurance Department. PA hospitals verified clinical outcomes data, and HMO plans verified payor information listed in the hospital-submitted records. The following paragraphs identify data included from the various data sources.

Hospital-Submitted Data: HMO Verification of Payor

The process used by PHC4 to identify specific managed care payors reported in the hospital-submitted records relied primarily upon the National Association of Insurance Commissioners (NAIC) code in the discharge record. All records identified as a managed care payor NAIC code were directly assigned to the respective payor for verification. A record was sent to a managed care payor if any part of a discharge record pointed to that particular managed care plan as the payor. This was necessary to assure inclusion of all appropriate records.

Exact identification of primary payor was difficult for managed care plans that market several products under one generic product or company name. The most common difficulty was separation of commercial (usually employer-paid) from government-contracted (primarily Medical Assistance) HMO members for the same plan.

The verification process allowed HMO plans three options: 1) verify and return a record for inclusion in the analyses, 2) delete 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 addition to a hospital discharge record, and 3) no other plan in the statewide database claimed the same record (see section below entitled "DETERMINATION OF PAYOR ASSOCIATED WITH AN EPISODE OF CARE").

As expected, especially for plans with multiple types and names of managed care products, some plans deleted up to 40 percent of the records included in the file for verification. After analysis, these deletions occurred for three common reasons:

- The patient was enrolled in a government-contracted HMO/POS plan, or a related PPO.
- The patient was enrolled in an out-of-state HMO.
- The patient was enrolled in a managed care POS plan licensed by a traditional fee-for-service plan (the PHC4 *Managed Care Performance Report* includes only those HMOs and related POSs licensed by the Department of Health).

Every HMO or related POS plan receiving a file for verification reviewed and returned the verified record to PHC4.

The methodology implemented in the *Managed Care Performance Report*, as developed by the Council, is discussed in later sections of this *Technical Report.*

NCQA

The National Committee for Quality Assurance (NCQA) is a private, not-for-profit organization dedicated to assessing and reporting on the quality of managed care plans. According to the NCQA website on the world wide web (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 consumer surveys that assess health plan performance (HEDIS, see below) and member satisfaction with their HMO (CAHPS, see below). 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 HEDIS and CAHPS data from NCQA's *Quality Compass* (1998 calendar year) are included in this report.

HEDIS Measures. The Health Plan Employer Data and Information Set (HEDIS) is a health plan performance tool developed by NCQA and is a component of the NCQA accreditation process. Three HEDIS *Effectiveness of Care* measures are included in this report:

- Use of Beta Blocker Treatments After a Heart Attack
- Advising Smokers to Quit
- Cervical Cancer Screening

Use of Beta Blocker Treatments 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, 1998 through December 31, 1998 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 the treatment. For a complete discussion of the data specifications and contraindications refer to the *HEDIS 1999 Technical Specifications, Volume 2* (page 75) published by NCQA.

Advising Smokers to Quit is reported as the percent of commercial HMO members age 18 years and older as of December 31, 1998 who were continuously enrolled during 1998, were either current smokers or recent quitters, were seen by a plan provider during the reporting year, and received advice to quit smoking during 1998 from a plan practitioner (*HEDIS 1999 Technical Specifications, Volume 2*, page 45). Pages 45 through 47 of the *Technical Specifications* provide a detailed description of the calculations used to determine the numerator and denominator for this measure.

Cervical Cancer Screening is reported as the percent of commercially-enrolled women, age 21 through 64 years, who were continuously enrolled during the reporting year and received one or more Pap test(s) during the reporting year or during the two years prior to the reporting year (*HEDIS 1999 Technical Specifications, Volume 2*, page 55). Pages 55 through 58 of the *Technical Specifications* provide a detailed description of the calculations used to determine the numerator and denominator for this measure.

It is important to note that participation in NCQA accreditation activities is voluntary; hence, not every commercial HMO licensed in Pennsylvania submits data to be included in the *Quality Compass*. The *Managed Care Performance Report* includes 1998 (calendar year) HEDIS scores for the following ten Pennsylvania plans (12 lines of business):

- Aetna U.S. Healthcare
- CIGNA Healthcare
- First Priority Health (HMO of Northeast PA)
- HealthAmerica (HMO)
- HealthAmerica (POS)
- HealthCentral
- HealthGuard of Lancaster
- Highmark Blue Cross/Blue Shield (Select Blue POS)
- Keystone Health Plan Central
- Keystone Health Plan East
- Keystone Health Plan West
- Penn State Geisinger Health Plan

The report includes benchmark scores *for Use of Beta Blocker Treatments after a Heart Attack* and for *Cervical Cancer Screening*. The "Pennsylvania HMO Average" for each measure is obtained from the *Quality Compass*. For calendar year 1998, three benchmarks for Pennsylvania are provided by NCQA: "HMO only", "HMO/POS", and "POS only". The scores shown in the *Managed Care Performance Report* include the "HMO only" benchmark.

CAHPS Measures. Another important component of the NCQA accreditation process is the Consumer Assessment of Health Plans Study (CAHPS) survey instrument. Commercial HMOs hire vendors from an NCQA-approved list to administer this member satisfaction survey.

The *Managed Care Performance Report* includes 1998 (calendar year) CAHPS scores for nine Pennsylvania plans (11 lines of business; those plans listed above for the HEDIS measures, excluding CIGNA Healthcare).

The following CAHPS Survey Questions are included in the *Managed Care Performance Report* for calendar year 1998:

- 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 long did you usually have to wait between trying to get care 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?"

Many of the survey items allow for multiple responses. For instance, in answer to the question "Was it a problem to get a referral to a specialist that you needed to see" (Question 10), a respondent may say "yes" to an initial referral during 1998, but "no" to a second referral during the same year.

Because NCQA reports only the percentage for each item response (not the number of responses), the total response rate (100%) in the *Quality Compass Report* includes valid responses as well as a proportion of multiple/missing responses. Only data for **valid** responses are included in the *Managed Care Performance Report*; an adjustment is made to account for multiple/missing responses. To achieve this, the percentages of only the valid responses are summed to give a percentage of *total valid responses (93.13% in the example below)*. The percentage for each valid response group is then divided by the percentage of total valid responses. As a result of these refinements, response categories consistently add up to 100 percent, and survey data can be reliably compared over several years. For instance, for Question 41 (see below) the percentages reported by PHC4 are calculated in the following manner:

Q41: 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?

Reponses Reported in Quality Compass:		Adjusted Responses Reported in the PHC4 *Managed Care Performance Report*:	
A big problem	10.15%	A big problem	10.90% **(10.15/93.13)**
A small problem	19.70%	A small problem	21.15% (19.70/93.13)
Not a problem	63.28%	Not a problem	67.95% (63.28/93.13)
Total valid responses	**93.13%**	**Total**	**100.00%**
Multiple responses/missing	6.87%		
Total	**100.00%**		

Certain CAHPS measures in the report have Pennsylvania HMO and National benchmarks. Both benchmarks are taken from the NCQA *Quality Compass*. The National benchmark includes all lines of business; the Pennsylvania HMO benchmark includes only Pennsylvania HMOs. Plans classified as "HMO/POS" or "POS only" are not included in this benchmark.

Pennsylvania Department of Health

Each HMO licensed by the Pennsylvania Department of Health files an *Annual Report* each April that includes data from the previous calendar year (up to December 31st). Information from these *Annual Reports* is included in the "Access, Service and Prevention" section of the *Managed Care Performance Report* and is described as follows:

- The number of commercial members (as of December 31, 1998) is found in section III.A. columns 1 through 4 of the *Annual Report*. Enrollment numbers reported in the *Managed Care Performance Report* (identified as the "Number of Commercial Members") reflect the sum of these columns. The same procedure is followed for the December 31, 1997 *Annual Report*. The 1997 totals are then subtracted from the 1998 totals and the percent change is reported (identified as the "Change in Commercial Enrollment" variable in the *Managed Care Performance Report*).

- The "Number of Primary Care Physicians" reported in the *Managed Care Performance Report* is the sum of the four PCP categories (Family Practice/Group Practice, Pediatric, General Internal Medicine, and Other) found in section IV.C., item number 1 of the *Annual Report*. This total is divided by the "Number of Commercial Members" variable and multiplied by 1,000 (identified as the "Number of PCPs per 1,000 Commercial Members"). The "Number of Specialists in the Network" variable is found in section IV.C., item number 2. This number is divided by the "Number of Commercial Members" variable and multiplied by 1,000 (identified as the "Number of Specialists per 1,000 Commercial Members" in the *Managed Care Performance Report*).

- The "Number of General Acute Care (GAC) Hospitals in the Network" variable reported in the *Managed Care Performance Report* is taken from each HMO's most recent Provider Directory filed with the Department of Health. PHC4 tallies the number of GAC hospitals in the counties where, according to the Department of Health's *Annual Report*, each plan is licensed to do business. The "Number of GAC Hospitals in the Network" is then divided by the total number of GAC hospitals for the HMO's service area 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 is determined and reported as "Additional GAC Hospitals in Network".

- The "NCQA Accreditation Status" variable is obtained from the NCQA web site and is current as of June 1, 2000.

Pennsylvania Insurance Department

Each HMO is required to file an annual, audited statement with the Pennsylvania Insurance Department (PID) containing a variety of financial indicators. The PID, at the request of the managed care plans, supplies all financial data included in the *Managed Care Performance Report*.

Only dollar amounts specific to *commercial HMO membership* are included in the *Managed Care Performance Report* (no government-contracted HMO members are included). All figures listed in the financial section of the report (i.e., "PLAN PROFILE: Financial Indicators") are taken from the 1998 *Annual Report* of each plan as described below:

- Total Revenue, Total Medical and Hospital, Total Administration, and Profit After Taxes figures are taken directly from the Exhibit "ANALYSIS OF OPERATIONS BY LINES OF BUSINESS" (Column 2 or Column 3) *for commercial lines of business only.* Total Revenue is found on line 7 of the *Annual Report* and Profit After Taxes is found on line 27.

- The Medical Loss Ratio is Total Medical / Total Premium Revenue.

- Information about Administrative Service Organizations (ASO), Administrative Services Contracts, Dental, Federal Employee Plans, Medicare, Medicaid and Individual Lines of Business is not included in the PHC4 *Managed Care Performance Report.*

- Total Revenue includes Premium and Net Investment Income.

- Total Medical is the net sum of Reinsurance Recoveries and Coordination of Benefits (COB).

PHC4 Data

Four clinical conditions were selected for inclusion in the *Managed Care Performance Report* because of: (1) inpatient hospitalization volume, (2) the high cost associated with treatments, (3) the potential role of managed care plans in prevention and management of each condition, and (4) the high degree of interest in these clinical conditions among purchasers and consumers.

This report will include outcome measures specific to the following four clinical conditions:

- Asthma (reported separately for pediatric and adult hospitalizations)
- Acute myocardial infarction (AMI; heart attack)
- Heart failure
- Elective hysterectomy (non-malignant/non-emergent; reported separately for abdominal and vaginal procedures)

Refer to Appendix A: Description of Study Population by ICD.9.CM Code that outlines the diagnosis and procedure codes used to define each clinical condition in the *Managed Care Performance Report*.

OUTCOME MEASURES AND DEFINITIONS

The outcome measures described in this report are tailored to each clinical condition. Only those outcomes pertinent to the given dinical condition are reported. Listed below are the outcome measures reported for each of the four clinical conditions described in this report.

Clinical Condition	**Outcome Measure**
Asthma	❑ Hospitalization rate (age/sex-adjusted; per 10,000 members) ❑ Risk-adjusted length of stay ❑ Risk-adjusted readmission rate (adult only)
AMI	❑ Hospitalization rate (age/sex-adjusted; per 10,000 members) ❑ Risk-adjusted in-hospital mortality rate ❑ Risk-adjusted average number of days hospitalized ❑ Percentage of patients undergoing a diagnostic cardiac catheterization procedure ❑ Percentage of patients undergoing a PTCA/stent procedure ❑ Percentage of patients undergoing a coronary artery bypass graft (CABG) procedure ❑ Percent of patients receiving a prescription for beta blockers following an AMI
Heart Failure	❑ Hospitalization rate (age/sex-adjusted; per 10,000 members) ❑ Risk-adjusted in-hospital mortality rate ❑ Risk-adjusted length of stay ❑ Risk-adjusted readmission rate
Hysterectomy	❑ Hospitalization rate (age-adjusted; per 10,000 female members) ❑ Risk-adjusted in-hospital complication rate ❑ Risk-adjusted length of stay ❑ Cervical cancer screening

DESCRIPTION OF EPISODE OF CARE AND "WHAT" IS ANALYZED

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 (i.e., transfers) coupled by date. 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). The "**index hospitalization**" is the hospitalization that initiates the episode; it is the first hospitalization (meeting the study population inclusion criteria) in the episode. Thus, a string of multiple, contiguous hospitalizations following the index hospitalization are coupled together into a single medical event or episode of care. Yet, for some patients an episode of care may be composed of only a single hospitalization in which there are no additional hospitalizations coupled to the index hospitalization.

"What" is Analyzed

Clinical information used to evaluate particular outcome measures may be taken from *all* or only *a portion* of the hospitalizations within a multiple-hospitalization episode, depending on the outcome measure and clinical condition being investigated. Accordingly, all hospitalizations (in a multiple-hospitalization episode) may not necessarily be used for each outcome measure associated with a clinical condition. For example, for adult asthma cases, the main component of analysis involves the index hospitalization only. Therefore, for hospitalization rate, length of stay analyses, and readmission rate (the outcome measures analyzed for adult asthma) the index hospitalization is the main unit of analysis. For each outcome measure within a clinical condition, however, additional information may be needed from other hospitalizations (in addition to the main component) to make accurate assessments of the effectiveness of care. In the case of adult asthma, while the main unit of analysis is the index hospitalization, the last acute care hospitalization in the asthma episode must be used as the reference in order to determine accurately a readmission beginning within 90 days. That is, for asthma readmission analysis, a hospitalization (respiratory-related) that begins no more than 90 days following the discharge date of the last hospitalization in the episode is included in the readmission analysis. It is necessary to use the last hospitalization in the episode as the reference; using only the index hospitalization as the reference would not portray an accurate assessment of the readmission rate across all asthma patients.

Table 1A summarizes the main components used in the analyses for each clinical condition in the *Managed Care Performance Report*. The components used are different for each outcome measure within a clinical condition grouping since the clinical management and delivery of health care varies for each condition. Table 1B lists the hospitalizations from which clinical information is extracted for each applicable outcome measure. The particular hospitalization(s) that is/are used in the examination of any one particular outcome measure within a clinical condition category are listed in bold print under each outcome measure in the methodology sections below. Refer to subsequent sections of this report that pertain to each clinical condition for detailed descriptions of the particular hospitalizations used for each relevant outcome measure.

Table 1A. "What" is analyzed: A Comparison among Clinical Conditions

Asthma - Adult	*Asthma - Pediatric*	*AMI*	*Heart Failure*	*Hysterectomy*
The index *asthma* hospitalization only	A single hospitalization for *asthma*	All hospitalizations that are part of an episode that begins no more than 30 days after the index AMI hospitalization	All *heart failure*-related hospitalizations within an episode	A single hospitalization for a *hysterectomy procedure*

Table 1B. Hospitalizations[1] Used for Outcome Measures

OUTCOME MEASURE	HOSPITALIZATIONS USED			
	Asthma (Adult and Pediatric)	*AMI*	*Heart Failure*	*Hysterectomy*
• Hospitalization rate per 10,000 members	Adult: index hospitalization only Pediatric: single hospitalization	Patient's index hospitalization	Index hospitalization only	Single hospitalization
• Length of Stay/Average Number of Days Hospitalized	Adult: index hospitalization only Pediatric: single hospitalization	All hospitalizations[2] beginning no more than 30 days from the admission date of the index AMI hospitalization	All hospitalizations for *heart failure* within episode	Single hospitalization
• In-hospital Mortality	N/A	*Any* hospitalization[2] ending in death where the death occurred no more than 30 days after the admit date of the index AMI hospitalization	All hospitalizations for heart failure that ended in death	N/A
• Readmission Rate	Adult only; any respiratory-related hospitalization beginning no more than 90 days after the discharge date of the last acute care hospitalization[3] in the episode	N/A	A hospitalization for heart failure beginning no more than 90 days after the discharge date of the last acute care hospitalization[4] in the episode	N/A
• Cardiac Catheterization Percentage	N/A	*Any* hospitalization[2], in which a catheterization procedure was performed no more than 30 days after (or 3 days prior to) the date of admission of the index hospitalization	N/A	N/A
• Cardiac Procedure[5] Percentage	N/A	*Any* hospitalization[2], in which a cardiac procedure was performed no more than 30 days after the date of admission of the index hospitalization	N/A	N/A
• In-hospital Complication Rate	N/A	N/A	N/A	Single hospitalization

[1] Includes those hospitalizations from which clinical information (needed for the associated outcome measure) is extracted.
[2] Non-index hospitalization that may or may not have a principal diagnosis of AMI.
[3] Non-index hospitalization that may or may not have a principal diagnosis of asthma.
[4] Non-index hospitalization that may or may not have a principal diagnosis of heart failure.
[5] Includes PTCA/stent, or CABG procedures

PROCEDURES USED FOR LINKING HOSPITALIZATIONS

Since identification of a patient's hospitalization history is crucial for a number of the clinical outcome measures investigated in this report, all hospitalizations and episodes in the study period are identified for each patient when possible. Many of the episodes contain at least one acute care hospitalization meeting the original study population criteria while some do not. Those hospitalizations within an episode that have a principal diagnosis that is different from the index hospitalization are still considered in creating a patient's hospitalization history since such records could potentially be used in subsequent outcome analyses. For example, since the definition of a readmission differs for each clinical condition, it is necessary to consider a wide range of hospitalizations (independent of principal diagnosis) that followed an index hospitalization as potential readmission hospitalizations. Thus, additional acute care hospitalizations (for an individual patient) occurring after the index hospitalization are retained in the dataset as potential readmission cases.

The patient identifier is fundamental to identifying each hospitalization and episode(s) for any individual patient. The patient's social security number (SSN) is used as the basic identifier; only valid SSNs are potentially usable. Patients with valid SSNs are excluded from the episode-identification task if any hospitalization contains an invalid sex, birth date, admit date, or discharge date value.

In addition, for an SSN to be retained, the same sex-birth date combination must have been reported for all hospitalizations with that SSN. If there were conflicting sex-birth date combinations, these multiple combinations must have been reconciled based on the methodology used by PHC4 to link appropriate acute care hospitalizations (refer to Appendix B: Methods for Resolving Inconsistent Patient Identifier Information).

DETERMINATION OF PAYOR ASSOCIATED WITH AN EPISODE OF CARE

After the verification process, hospital records were subsequently linked with other hospital records for the same patient from the PHC4 Inpatient Database of Record, in order to determine episodes of care for the individual patients.

If an episode of care consisted of a single hospitalization, then the episode was attributed to the payor that claimed that hospitalization (or "traditional fee-for-service" or "other" as appropriate). Similarly, if an episode of care consisted of multiple hospitalizations that were all claimed by the same payor, then the episode was attributed to that payor.

In rare instances, an episode of care may have included hospitalizations that were claimed by different payors. Furthermore, it is also possible that one or more of the records in the episode were not claimed at all, if such records did not meet the inclusion criteria but were part of a series of acute care hospitalizations in which one of the hospitalizations met the appropriate inclusion criteria. If this occurred, then the entire episode was assigned to one payor according to this hierarchy:

1. If two hospitalizations in the same episode were assigned to two different HMO plans, then the entire episode was assigned to the "other" group and excluded from either of the HMO plans. (This only occurred in one episode/2 records in the heart failure analysis.)

2. If one or more of the hospitalizations in a single episode was claimed by an HMO, and no other HMO claimed any of the other hospitalizations in the episode, then all of the hospitalizations in the episode were attributed to the respective HMO.

3. If one or more hospitalizations in an episode were assigned to "traditional fee-for-service", and none of the other hospitalizations in the episode were attributed to an HMO, then the other hospitalizations in the episode were also attributed to "traditional fee-for-service".

4. If none of the hospitalizations in the episode were attributed to an HMO or to "traditional fee-for-service", then all of the hospitalizations in the episode were attributed to "other".

This methodology led to the re-assignment to or exclusion from hospitalization records from payor groups as follows:

AMI Analysis:

Payor Was	Payor Is Now	Count of hospitalizations
Traditional fee-for-service	Traditional fee-for-service	3,329
Other	Traditional fee-for-service	300
Traditional fee-for-service	HMO	17
HMO	HMO	3,766
Other	HMO	109
Other	Other	7,194
Traditional fee-for-service	excluded	72
HMO	excluded	85
Other	excluded	218

Hysterectomy Analysis:

Payor Was	Payor Is Now	Count of hospitalizations
Traditional fee-for-service	Traditional fee-for-service	5,242
HMO	HMO	6,117
Other	Other	7,644
Other	excluded	1

Asthma Analysis:

Payor Was	Payor Is Now	Count of hospitalizations
Traditional fee-for-service	Traditional fee-for-service	1,688
HMO	HMO	3,238
Other	HMO	4
Other	Other	11,033
Traditional fee-for-service	excluded	1
Other	excluded	4

Heart Failure Analysis:

Payor Was	Payor Is Now	Count of hospitalizations
Traditional fee-for-service	Traditional fee-for-service	1,533
Other	Traditional fee-for-service	26
Traditional fee-for-service	HMO	4
HMO	HMO	1,860
Other	HMO	6
HMO	Other	2[†]
Other	Other	9,240
Traditional fee-for-service	excluded	9
HMO	excluded	9

[†] These are the records claimed by two separate payors

EXCLUSION CRITERIA

To account for clinical complexities and other special circumstances associated with each clinical condition and corresponding outcome measure, distinct restrictions and limitations (i.e., exclusion criteria) are incorporated into the current methodology. Specific information about the outcome measures and exclusions to the analyses for each clinical condition are described in the appropriate methodology sections (see "ASTHMA", "AMI", "HEART FAILURE", and "HYSTERECTOMY" sections below). Table 2 summarizes the outcome measures and the corresponding exclusions for each of the clinical conditions studied in the *Managed Care Performance Report*.

Table 2. *FY99 Managed Care Performance Report:* EXCLUSIONS TO ANALYSES

Asthma, Adult

Hospitalization Rate
- Tracheostomy
- Lung cancer
- Metastatic cancer - other than lung

Length of Stay
- Hospitalization Rate exclusions *plus:*
- Death in hospital
- Missing *Atlas* PLOS
- Outliers

Readmission Rate - 90 days
- Length-of-Stay exclusions *plus:*
- Invalid SSN,
- Invalid dates/gender
- Inconsistent SSN, sex, DOB

Asthma, Pediatric

Hospitalization Rate[2]
- Neonates (< 28 days)
- Lung cancer
- Metastatic cancer - other than lung

Length of Stay
- Hospitalization Rate exclusions *plus:*
- Missing *Atlas* PLOS
- Outliers

AMI

Hospitalization Rate
- Age < 18 years
- Age > 64 years[3]
- Metastatic cancer
- Transplants:
  - Heart
  - Heart/lung

In-Hospital Mortality Rate - 30 days
- Hospitalization Rate exclusions *plus:*
- Missing *Atlas* ASG in index hospitalization
- Invalid SSN/dates/gender
- Inconsistent SSN/gender/DOB

Average Number of Days Hospitalized
- In-Hospital Mortality exclusions *plus:*
- Death in hospital within 30 days
- Death in hospital after 30 days
- Outliers

Cardiac Catheterization Percentage - 30 days
- Hospitalization Rate exclusions

PTCA/Stent Percentage - 30 days
- Hospitalization Rate exclusions

CABG Percentage - 30 days
- Hospitalization Rate exclusions

Beta Blocker Use Post-AMI
- As defined by NCQA

Heart Failure

Hospitalization Rate
- Age < 18 years
- Age > 64 years[3]
- Transplants:
  - Heart
  - Kidney
  - Heart/lung
- Metastatic cancer

In-Hospital Mortality Rate
- Hospitalization Rate exclusions *plus:*
- Missing *Atlas* ASG

Length of Stay
- In-Hospital Mortality Rate exclusions *plus:*
- Death in a heart failure hospitalization within an episode
- Outliers

Readmission Rate - 90 days
- Length-of-Stay exclusions *plus:*
- Death in a non-heart failure hospitalization within an episode
- Invalid SSN
- Inconsistent SSN, gender, DOB

Hysterectomy[1]

Hospitalization Rate
- Age < 18 years
- Any cancer – other than "history of cancer"
- Hemorrhage on admission
- Pregnancy-related complications leading to hysterectomy

In-Hospital Complication Rate
- Hospitalization Rate exclusions *plus:*
- Missing *Atlas* PLOS

Length of Stay
- In-Hospital Complication Rate exclusions *plus:*
- Death in hospital
- Outliers

Cervical Cancer Screening
- As defined by NCQA

[1] Abdominal and vaginal surgical approaches inclusive; [2] Note, there were no tracheostomy records in the pediatric asthma patient population; [3] A small number of leftover hospitalizations were excluded after the data verification process.
List of Abbreviations: *Atlas* ASG: *Atlas*™ Admission Severity Group; *Atlas*™ PLOS: *Atlas*™ Predicted Length of Stay; DOB: Date of Birth; NCQA: National Committee for Quality Assurance; SSN: Social Security Number

DATA ANALYSIS

Sex and Age Adjustment Approach

Age and sex adjustments are similar in nature. The methods take into account, for example, an HMO that has a higher proportion of older patients, in comparison to a plan that has younger members. PHC4's system "expects" more health problems in the HMO with an older population and makes adjustments for that. Gender is often an important risk factor, particularly in heart disease, so the system accounts for differences among HMOs in this category as well. The hospitalization data are adjusted using age and sex cohorts derived from the total membership population of each HMO.

Risk Adjustment Approach

Based on a complex mathematical formula that assesses the degree of illness or risk for patients, PHC4 calculates expected, or predicted, numbers or rates. Managed care plans that have sicker members are given "credit" in the system; patients that are more seriously ill can be expected to have a greater probability of death, to have longer lengths of stay, to be readmitted, or to have complications. These events are "expected". This system is used to measure outcomes taking into account patient illness or risk factors.

Atlas™ Admission Severity Approach for Risk Adjustment. In a contractual agreement with MediQual Systems, Inc. in Marlborough, Massachusetts, hospitals are required to use MediQual's *Atlas* Severity of Illness System to classify each patient's condition upon admission to the hospital and covering the first two days of the hospital stay. This system represents a summarization of patient risk/severity, characterized as the probability of in-hospital death or the predicted length of stay (PLOS), and is based on clinical data found in the medical record. Ultimately, this system is used to risk-adjust outcomes to allow for fair comparisons among HMO plans.

The *Atlas* 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 PLOS. The *Atlas* system utilizes 67 different disease-specific scoring algorithms to obtain the admission severity.

Two systems developed by *Atlas* to rate patient risk that PHC4 uses in this study are described below and include the probability of death measure (i.e., the ASG score, see below) and the PLOS:

Probability of Death: Admission Severity Groups

The algorithm-derived probability of death for any one patient is categorized into one of five groups, or Admission Severity Groups (ASG), ranked 0 to 4, which correspond to levels of patient risk. These ASG scores range from minimally sick (ASG 0) to maximum probability of death (ASG 4).

The ASG scores are assigned by *Atlas* as follows:

ASG	Description	Probability of Death
0	No risk of clinical instability	0.000 – 0.001
1	Minimum risk of clinical instability	0.002 – 0.011
2	Moderate risk of clinical instability	0.012 – 0.057
3	Severe risk of clinical instability	0.058 – 0.499
4	Maximum risk of clinical instability	0.500 – 1.000

Source: Atlas version 3.3, 2000 MediQual Systems, Inc.

PLOS: Predicted Length of Stay.

The PLOS is a continuous variable, meaning it has values that range on a continuum. In order to use PLOS as a risk-adjustment variable, the PLOS must be categorized. Four population percentiles are used to categorize the PLOS into five categories. The percentiles used are approximately the 2.5^{th}, 16^{th}, 84^{th}, and 97.5^{th} percentiles of the population's distribution curve.

CIC/MediQual *Atlas* disease groups 550 (myocardial infarction) and 560 (heart failure) are used to determine ASG scores for AMI and heart failure patients, respectively. *Atlas* disease groups 400 (asthma) and 1300 (female reproductive) are used to determine the PLOS for asthma and hysterectomy patients, respectively. The principal diagnosis determines the scoring algorithm used for a particular case.

Tables C1-C4 comprising Appendix C: *Atlas* Admission Severity Scoring provide more detail about each of the four disease groups and the corresponding clinical measures used in computing PLOS and ASG. Tables C.1c, C.2b, C.3b and C.4b list the ICD.9.CM codes associated with the four disease groups. Tables C.1a, C.1b, C.2a, C.3a and C.4a show the percentages of hospitalizations for each clinical condition in the *Managed Care Performance Report* that were coded according to the most predominant *Atlas* disease groups. Also included in this appendix is a list of the KCFs used to identify variables that predict the length of stay (referred to as "clinical LOS" in Appendix C) associated with asthma (Tables C.1d and C.1e) and hysterectomy (Tables C.4c and C.4d), or the likelihood of in-hospital death (referred to as "clinical mortality" in Appendix C) associated with AMI (Tables C.2c and C.2d) and heart failure (Tables C.3c and C.3d). Table C.5 is a complete list and description of all *Atlas* variables used in the determinations of Atlas PLOS or ASG for any one of the four conditions studied in the *Managed Care Performance Report* and includes the source documents referenced in a hospital medical record.

Eligibility criteria for considering a variable in a model are: a) the variable must be present in at least 3% of the hospitalizations, or b) the variable must occur in 1% of the hospitalizations if the data includes at least 30 deaths. Only variables found to be significant (after being entered into the appropriate CIC/MediQual algorithm) are included in the final model as *predictor variables*.

Determination of Risk-Adjustment Factors by PHC4. For each clinical condition in the *Managed Care Performance Report*, a list of potential risk factors is identified. Each of the three factors actually used for risk-adjusting are determined individually for each outcome measure using (forward) stepwise regression. For those outcome measures generated from

binary response factors (in-hospital mortality rate, in-hospital complication rate, and readmission rate), logistic regression is used. The length-of-stay outcome measure is created from a continuous factor and thus, linear regression techniques are used.

The first step in the stepwise process is to identify the risk factor that explains more of the variability among the specific response factor (i.e., in-hospital mortality rate, in-hospital complication rate, readmission rate, or length-of-stay) values than does any other individual risk factor. In the second step, the risk factor that, when coupled with the first factor, explains more response factor variability than any of the other remaining factors in the list when coupled with first factor. The third risk factor determined is that factor from the list that, when considered with the first two factors, explains the most response factor variability. The ability of each factor selected to account for response factor variability is required to be statistically significant at the 0.10 level. A stepwise selection method is a dynamic process since a factor selected at one step is removed at a later step if it is no longer statistically significant given the other factors that have been selected by that later step. *Note, this did not occur in any of the stepwise analyses required in preparing this report.*

Since regression techniques involving continuous factors are most sensitive when these factors are normally (i.e., bell-shaped) distributed, transformations of the data values are considered for length-of-stay, age, or *Atlas* PLOS if the sample distribution of the actual values is not approximately bell-shaped. Unless the data are completely skewed (i.e. with the highest frequency at the minimum or maximum possible value), a logarithmic or double-logarithmic transformation (logarithm of a logarithm) is used to achieve a bell-shaped distribution. The usage of any transformation is limited to the modeling analysis used to determine the three risk factors for an outcome measure.

Categorization of Risk Factors. As mentioned above, the PHC4 methodology uses three categorical risk factors. The strongest factor (i.e., the first risk factor determined in the selection process) can have at most five categories, while both the second and third factors can have a maximum of three categories each. Categories for any risk factor with more than the maximum number are combined to the extent necessary to make that risk factor compatible with the PHC4 methodology.

Prior collapsing of levels was required only for the hysterectomy risk factor "Principal Diagnosis Group" (used in the *length of stay* and *in-hospital complication rate* analyses) and the AMI risk factor *"Atlas* ASG" (used in the *average number of days hospitalized* analysis). "Principal Diagnosis Group" and *"Atlas* ASG" categories (originally five categories for each factor before combining) were independently combined into three new categories as follows:

Principal Diagnosis Group		***Atlas* ASG**	
New Category	*Combination*	*New Category*	*Combination*
1	Categories 1,2 and 3: Fibroids, Hyperplasia or Endometriosis	1	ASG groups 0 and 1
2	Category 4: Uterine prolapse	2	ASG group 2
3	Categories 5 and 6: Bleeding abnormalities + Other	3	ASG groups 3 and 4

See the text that follows for detailed information on the combinations implemented.

In order for a continuous risk factor ("age" or "*Atlas* PLOS") to be used in the PHC4 methodology, it must first be categorized. Specific sample percentiles were used to determine the limits for each category. Using sample percentiles ensures that the categorization process will generally result in populated categories. The percentiles used to determine the boundaries for five categories are approximately the 2.5^{th}, 16^{th}, 84^{th}, and 97.5^{th} percentiles. These boundaries correspond to the points on a bell-shaped curve of distribution that are: 1) two standard deviations below the population mean (i.e., 2.5^{th} percentile), 2) one standard deviation below the mean (i.e., 16^{th} percentile), 3) one standard deviation above the mean (i.e., 84^{th} percentile), and 4) two standard deviations above the mean (i.e., 97.5^{th} percentile).

If the distribution for a continuous factor was still somewhat skewed even after transforming the data for the risk factor determination process, the data values in the skewed part were separated for assignment to the last category (or first, if appropriate) and were not used in determining the category limits. If the continuous factor was the second or third factor in the PHC4 methodology process, the first and second, and the fourth and fifth, were combined to create a three-level categorization.

Shown below (and see Table 3) is the order in which the three most significant risk adjustors were ranked for the each clinical condition and appropriate outcome measure. The risk adjustor variable that explained the most variability was ranked #1, while the second and third variables were ranked #2 and #3, respectively. Appendix E: Risk Factors Considered lists all of the candidate variables evaluated as potential risk adjustors for each of the four clinical conditions and includes hospitalization information (e.g., average length of stay, mortality, complications, etc.) for each of the variables tested. Each of the final three risk adjustors was consequently subcategorized for the risk adjustment process. Listed below are the categories used for each of the risk adjustor variables for each clinical condition and applicable outcome measure. A minimum of 20 hospitalizations statewide per risk adjustor category was required for the statistical methods that were utilized. Risk adjustor categories containing less than 20 hospitalizations were combined as indicated below.

Adult Asthma

Length of Stay:

#1 *Atlas* PLOS Group - 5 categories:
- 1: below 2.938
- 2: 2.938 – 3.393
- 3: 3.394 – 5.124
- 4: 5.125 – 6.386
- 5: above 6.386

#2 Sex - 2 categories: Male or Female

#3 Race - 3 categories: Black, White or Other

Categories were combined when necessary as follows:
- Black and Other groups were combined
- Black, White, and Other groups were combined

Readmission Rate:

#1 Chronic Obstructive Asthma Group - 2 categories: Present or Absent

#2 Race - 3 categories: Black, White or Other

#3 Age - 3 categories:
- 1: 18yr-28yr
- 2: 29yr-55yr
- 3: 56yr-64yr

Categories were combined when necessary as follows:
- Categories 1 and 2 were combined

Pediatric Asthma

Length of Stay:
#1 *Atlas* PLOS Group - 5 categories:
1: below 2.442
2: 2.442 – 2.583
3: 2.584 – 3.214
4: 3.215 – 3.730
5: above 3.730
#2 Age - 3 categories:
1: 0
2: 1yr-11yr
3: 12yr-17yr
#3 Sex - 2 categories: Male or Female

AMI

In-hospital Mortality Rate:
#1 *Atlas* ASG Group - 5 categories: ASG 0 - 4
#2 AMI type – 2 categories: Q-wave, Non Q-wave
#3 Sex – 2 categories: Male, Female
Sex categories were combined into one category when necessary

Average Number of Days Hospitalized:
#1 Heart failure – 2 categories: Present, Absent
#2 *Atlas* ASG Group - 3 categories: (0 and 1), (2), (3 and 4)
#3 Age – 3 categories:
1: 18yr – 44 yr
2: 45yr – 61 yr
3: 62yr – 64 yr
Categories 2 and 3 were combined when necessary

Heart Failure

In-hospital Mortality Rate:
#1 *Atlas* ASG Group - 5 categories: ASG 0 - 4
#2 Diabetes – 3 categories: Absent, Present without complications, Present with complications
Categories were combined when necessary as follows:
- With and Without complication categories were combined
- None, With, and Without categories were combined

#3 Chronic renal failure – 2 categories: Present, Absent
Categories were combined into one category when necessary

Length of Stay:
#1 *Atlas* ASG Group - 5 categories: ASG 0 - 4
#2 Renal Dialysis – 2 categories: Present, Absent
Categories were combined into one category when necessary
#3 Diabetes – 3 categories: Absent, Present without complications, Present with complications
Categories were combined when necessary as follows:
- None, With, and Without categories were combined

Readmission Rate:
#1 *Atlas* ASG Group - 5 categories: ASG 0 - 4
#2 Race – 3 categories: Black, White, Other
Categories were combined when necessary as follows:
- Black and White categories were combined
- Black, White, and Other categories were combined

#3 Chronic renal failure – 2 categories: Present, Absent
Categories were combined into one category when necessary

Hysterectomy

In-hospital Complication Rate:
#1 Race - 3 categories: Black, White or Other
#2 *Atlas* PLOS Group - 3 categories:
1: below 2.702
2: 2.702 – 3.536
3: above 3.536

#3 Principal Diagnosis Group - 3 categories:
1: Fibroids, Hyperplasia or Endometriosis
2: Uterine prolapse
3: Bleeding abnormalities + Other
Categories 2 and 3 were combined when necessary

Length of Stay:
#1 *Atlas* PLOS Group - 5 categories:
1: below 2.421
2: 2.421 – 2.701
3: 2.702 – 3.534
4: 3.535 – 3.950
5: above 3.950

#2 Race - 3 categories: Black, White or Other
Black and Other categories were combined when necessary
#3 Principal Diagnosis Group - 3 categories:
1: Fibroids, Hyperplasia or Endometriosis
2: Uterine prolapse
3: Bleeding abnormalities + Other
Categories were combined when necessary as follows:
- Categories 2 and 3 were combined
- Categories 1, 2 and 3 were combined

Indirect Standardization. Statewide rates are used as the benchmark for *in-hospital mortality*, *complication*, and *readmission rates* analyses to statistically evaluate the associated rate within each HMO plan. That is, for each clinical condition in this study, the statewide rates are used as a comparative reference point. However, directly comparing the statewide rate to the associated HMO crude rate can be misleading. For example, when statistical modeling is used to evaluate the clinical condition of AMI, mortality rates vary by the ASG score assigned on admission, the AMI type (either Q-wave or non-Q-wave) and gender of the patient. Statewide, the distribution of these three risk factors may be very different than the dstribution of these same factors within a particular HMO plan. Indirect standardization is a technique that is used to adjust for these differences and allow for discrepancies in the risk factor structure between the state and each HMO plan.

Indirect standardization is also used to calculate the age- and sex-adjusted hospitalization rates for each HMO plan. Enrollment data, reported in age and sex categories, are collected from HMO plans only. Since this enrollment data is not available (that is, is not collected) from the insurance groups that comprise the "traditional fee for service" or the "other" categories (the remainder of the statewide population), those hospitalization rates can not be reported. Indirect standardization, using the risk factors of age and sex, is used to compare the hospitalization rates for each HMO plan against the statewide HMO-aggregated hospitalization rates for each clinical condition.

Risk Index Adjustment for Lengths of Stay Analyses. The risk-adjusted *lengths of stay* (LOS) averages are reported for each clinical condition by each HMO and traditional fee-for-service sample. *Lengths of stay* values may vary within a clinical condition due to variance in risk adjustor variables used. Therefore, in order to report a comparable risk-adjusted average *length of stay* for each of the clinical conditions within each HMO, a risk-adjustment technique is employed. The following steps are used:

1) Statewide relative weights for each risk adjustor variable combination within each clinical condition are determined using LOS averages aggregated from the statewide reference database. After all exclusions are satisfied and outliers removed, the relative weight for each risk adjustor combination within each clinical condition is calculated using the formula:

$$\text{Relative Weight} = \frac{\text{Average LOS for a cell (i.e., combination of risk adjustors)}}{\text{Average LOS for the clinical condition}}$$

2) Each HMO's risk index for each clinical condition is calculated:

$$\text{An HMO's risk index for a particular clinical condition} = \frac{\Sigma(n_I \times RW_I)}{\Sigma n_I}$$

where, for each of the risk adjustor combinations (cell) within the clinical condition,
RW_I = the statewide relative weight for the i^{th} combination (cell)
n_I = the number of hospitalizations for the HMO of the i^{th} combination
Σn_I = the total number of hospitalizations for the HMO plan for a clinical condition

3) For each HMO, the risk-adjusted average *length of stay* is then calculated for each of the clinical conditions:

$$\text{Risk-Adjusted Ave. Length of Stay} = \frac{\text{Ave. Length of Stay for a Clinical Condition}}{\text{Risk Index for a Clinical Condition}}$$

where the average LOS for an HMO's clinical condition is derived by adding up all the LOSs for the hospitalizations remaining in the analysis for that HMO's clinical condition and dividing by the number of hospitalizations.

Tests of Significance

Binomial versus Poisson Distributions. Significance tests were performed for the following outcomes:

Outcome Measure	Clinical Conditions	Distribution Used
In-Hospital Mortality Rate (Death vs. Discharged Alive)	AMI Heart Failure	Binomial
Readmission Rate (Readmission vs. No Readmission)	Adult Asthma Heart Failure	Binomial
In-Hospital Complication Rate (Complication vs. No Complication)	Hysterectomy	Binomial
Hospitalization Rate (Rate of hospitalizations for a given clinical condition per HMO population)	Asthma (adult/pediatric) AMI Heart Failure Hysterectomy	Poisson

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

The type of distribution chosen (i.e., binomial or Poisson) is based on the nature of the outcomes in question, and requires certain assumptions:

Binomial Distribution

- Each hospitalization included in the study has one of two observable outcomes (e.g., in-hospital death vs. live discharge). In other words, the response is dichotomous.
- The probability of death (or readmission, or complication) for each hospitalization studied within a clinical condition group (as adjusted by the risk factors for that clinical condition and outcome) is equal to the rate provided by the statewide reference database.
- The outcome for any one hospitalization in the analyses has no impact on the outcome of another “unit of analysis”. In other words, the units of analysis are independent.

Poisson Distribution

- The number of episodes possible for a given clinical condition within a year for a group of members may be any whole number.
- The rate of hospitalization for members within an age/sex category for a given clinical condition is equal to the rate calculated using the enrollment numbers provided by

the HMO plans and the hospitalization records in the HMO-aggregated reference database.

- The occurrence of a hospitalization in a group of members has no effect on the hospitalization rate for the remainder of the year for the group. In other words, the members are independent, and the rate of hospitalization is constant.

A probability distribution is created for each outcome within each HMO plan based on the expected value or expected rate (risk-adjusted and derived using the statewide reference database), and the type of distribution (binomial or Poisson) appropriate for the outcome. Using the probability distribution, a p-value is calculated for each observed value. This p-value is the probability, or likelihood, that the observed value could have occurred by chance. If it is very unlikely ($p < 0.05$; see "Inferential Error" section below) that the observed value could have occurred only by chance, then it is concluded that the observed value is "significantly different" from the expected value (see "Statistical Rating" section below).

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 has been set to 0.05. In the context of the *Managed Care Performance Report*, a Type I error occurs when the difference between the observed in-hospital mortality and the expected in-hospital mortality is declared statistically significant, when in fact, the difference is due to chance. That is, for a particular clinical condition, the HMO plan is declared to be statistically higher or lower than expected, when in reality the HMO plan's level of performance is comparable to the state norm. Since the level of significance has been set to 0.05, there is a 5% (or 1 in 20) chance of committing this type of error.

Outcome Measures using the Binomial Test. The binomial distribution is used to determine the p-value used to test for significant differences between observed and expected rates for the following outcome measures: in-hospital mortality rate, complication rate, and readmission rate. The p-value is calculated as shown below.

p-value Calculation: Binomial Distribution

Calculating the p-value for the binomial test is defined by a formula which sums discrete probabilities based upon the binomial distribution. The binomial formula (see below) is 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 mortality analysis),

P(X=a) is the probability that the binomial random variable (X) takes on a specific value (a); "a" for actual

X is the binomial random variable (X is a discrete random variable which can range from 0 through N ($0 \leq X \leq N$); 0 = no mortalities, N = all are mortalities

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

a is the actual number of observed in-hospital deaths for a particular HMO plan's clinical condition

p is the estimated probability of patient death for a particular HMO plan's clinical condition

Through a series of calculations, the p-value associated with the observed number of mortalities is calculated for each HMO plan and clinical condition. The same calculations are used to compute p-values for complications and readmission.

Actual versus Expected Rates (of in-hospital mortality, complications and readmissions)

Using AMI in-hospital mortality as an example, ASG, AMI type and sex are used as risk adjustors in this analysis. The *expected* statewide mortality rate is calculated for each of the final combinations of risk adjustor factors (i.e., ASG/AMI type/sex combinations). The same approach is taken to calculate the expected mortality rate for heart failure, using the risk adjustor factors specific to heart failure (i.e., ASG, diabetes and chronic renal failure). Similarly, the expected complication rates and readmission rates are calculated using the risk adjustor factors specific to each clinical condition studied. Expected rates are computed for each risk adjustor combination by dividing the total number of deaths (or complications, or readmissions) in that combination by the total number of patients in that combination.

Using, again, in-hospital mortality as an example, the *actual* or observed in-hospital mortality rate is the number of deaths for each HMO within each clinical condition. The number of deaths expected for each HMO within each clinical condition is calculated using the statewide-expected (or average) mortality rates for each of the risk adjustor category combinations for a particular clinical condition. The same approach is used to determine the actual complication rates and readmission rates, using the risk adjustor combinations specific to each clinical condition.

Since there are various combinations of risk adjustor variables for each outcome measure and clinical condition, the variable **i** shown in the calculation for the expected number of deaths covers a range of possible combinations, depending upon the outcome measure and clinical condition being studied. For a particular clinical condition and outcome measure, the maximum of the variable **i** is given by the number of final combinations of the risk adjustor factors. The **i^{th}** combination is a generic term used to signify each of the final combinations of these risk adjustor categories.

The expected number of mortalities for each clinical condition within each HMO is calculated as follows:

Expected number of deaths = $\Sigma(p_i \times n_i)$

where, for each of the final combinations of the risk adjustors within the clinical condition,

p_i = the statewide mortality rate for the i^{th} combination
n_i = the number of hospitalizations for the HMO of the i^{th} combination

The estimated probability of death, p, for each clinical condition within each HMO is calculated as follows:

p = (expected number of deaths)/N

where N = the total number of hospitalizations for a particular clinical condition within a particular HMO. (*note:* $\Sigma n_i = N$)

Similar calculations are made for Readmission Rate and Complication Rate analyses using the statewide rates and risk adjustor combinations specific to each clinical condition and outcome measure.

Outcome Measures using the Poisson Test. The Poisson distribution is used to determine the p-value used for hospitalization rate analyses; it is used to test for significant differences between observed and expected/average hospitalization rates. The p-value is calculated as shown below.

p-value Calculation: Poisson Distribution

The Poisson formula is defined by the following equation:

$$P(X=a) = (e^{-\mu}\ \mu^{a})/a!$$

where,

- P(X=a) is the probability that the Poisson random variable (X) takes on a specific value (a)
- X is the Poisson random variable (X is a discrete random variable taking on the value of a whole number where $X \geq 0$)
- a is the actual number of hospitalizations for a particular HMO plan's clinical condition
- μ is the estimated number of hospitalizations for a particular HMO plan's clinical condition, based on age and sex distributions
- *e* is a constant (i.e., the natural base: approximately 2.71828…)

Calculation of Hospitalization Rate

The average/expected rate of hospitalization for a single HMO plan is determined as:

$$(\text{Expected Rate}) = \frac{\sum_{\text{Age*Sex Cell}} \left(\frac{\text{Number Of Hosp. Episodes For All MCOs}}{\text{Number Of Enrollees For All MCOs}} \right) (\text{Number Of Enrollees For Plan})}{(\text{Total Number Of Enrollees For Plan})}$$

And the observed rate of the plan will be:

$$(\text{Observed Rate}) = \frac{(\text{Total Number of Hospitalization Episodes})}{(\text{Total Number of Enrollees})}$$

Statistical Rating. A statistical rating is assigned to each HMO if the difference between what was observed and what was expected (the statewide average) in a particular clinical condition is statistically significant. The p-value, calculated in terms of a "two-tailed" test is compared to the level of significance.

For example, in the calculation of in-hospital mortality for each HMO,

- If the calculated p-value is greater than 0.05, then the conclusion is made that the difference between what was expected and what was observed is *not* statistically

significant. It *cannot be concluded* that the in-hospital mortality rate for that particular clinical condition in that particular HMO is different from the total commercial HMO population statewide.

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

  - If the observed in-hospital mortality rate is *less than* expected, which is based on the statewide in-hospital mortality rate, the HMO is assigned the open circle symbol (as shown in the *Managed Care Performance Report*) to indicate that mortality was significantly less than expected for a particular clinical condition.

  - If the observed in-hospital mortality is *higher than* expected, which is based on the statewide in-hospital mortality rate, the HMO is assigned the filled circle symbol (as shown in the *Managed Care Performance Report*) to indicate that mortality was significantly greater than expected for a particular clinical condition.

Statistical ratings (using a level of significance of 0.05) are reported for the following outcome measures: in-hospital mortality rate, hospitalization rate, readmission rate and in-hospital complication rate. In the *Managed Care Performance Report*, statistical ratings are shown for HMO plans that have sufficient records. When the number of records for analysis is 10 or less, a statistical rating is not reported and the symbol "NR" appears in the *Managed Care Performance Report*.

Table 3 summarizes the outcome measures, the tests of significance, and the corresponding risk adjustor variables for each of the clinical conditions studied in the *Managed Care Performance Report.*

Table 3. *FY99 Managed Care Performance Report:* RISK ADJUSTMENT APPROACH[1]

Asthma, Adult

Hospitalization Rate
- Approach: Indirect standardization
- Age cohort[2]- and sex-adjusted
- Significance test: Poisson
- Confidence level: 95%

Length of Stay
- Approach: Risk index adjustment
- Risk adjustors (ranked):
  - #1 *Atlas* PLOS[4] group
  - #2 Sex
  - #3 Race
- Significance test: none

Readmission Rate - 90 days
- Approach: Indirect standardization
- Risk adjustors (ranked):
  - #1 Chronic obstructive asthma
  - #2 Race
  - #3 Age
- Significance test: binomial
- Confidence level: 95%

Asthma, Pediatric

Hospitalization Rate
- Approach: Indirect standardization
- Age cohort[3]- and sex-adjusted
- Significance test: Poisson
- Confidence level: 95%

Length of Stay
- Approach: Risk index adjustment
- Risk adjustors (ranked):
  - #1 *Atlas* PLOS[4] group
  - #2 Age
  - #3 Sex
- Significance test: none

AMI

Hospitalization Rate
- Approach: Indirect standardization
- Age cohort[2]- and sex-adjusted
- Significance test: Poisson
- Confidence level: 95%

In-Hospital Mortality Rate - 30 days
- Approach: Indirect standardization
- Risk adjustors:
  - #1 *Atlas* ASG[5]
  - #2 AMI type[6]
  - #3 Sex
- Significance test: binomial
- Confidence level: 95%

Average Number of Days Hospitalized
- Approach: Risk index adjustment
- Risk adjustors:
  - #1 Heart failure
  - #2 *Atlas* ASG[5]
  - #3 Age
- Significance test: none

Cardiac Catheterization Percentage - 30 days
- No risk adjustors used

PTCA/Stent Percentage - 30 days
- No risk adjustors used

CABG Percentage - 30 days
- No risk adjustors used

Use of Beta Blockers Following an AMI
- As defined by NCQA

Heart Failure

Hospitalization Rate
- Approach: Indirect standardization
- Age cohort[2]- and sex-adjusted
- Significance test: Poisson
- Confidence level: 95%

In-Hospital Mortality Rate
- Approach: Indirect standardization
- Risk adjustors (ranked):
  - #1 *Atlas* ASG[5]
  - #2 Diabetes
  - #3 Chronic renal failure
- Significance test: binomial
- Confidence level: 95%

Length of Stay
- Approach: Risk index adjustment
- Risk adjustors (ranked):
  - #1 *Atlas* ASG[5]
  - #2 Dialysis
  - #3 Diabetes
- Significance test: none

Readmission Rate - 90 days
- Approach: Indirect standardization
- Risk adjustors (ranked):
  - #1 *Atlas* ASG[5]
  - #2 Race
  - #3 Chronic renal failure
- Significance test: binomial
- Confidence interval: 95%

Hysterectomy

Hospitalization Rate
- Approach: Indirect standardization
- Age cohort[2]-adjusted
- Significance test: Poisson
- Confidence level: 95%

In-Hospital Complication Rate
- Approach: Indirect standardization
- Risk adjustors (ranked):
  - #1 Race
  - #2 *Atlas* PLOS[4] group
  - #3 Principal diagnosis group
- Significance test: binomial
- Confidence interval: 95%

Length of Stay
- Approach: Risk index adjustment
- Risk adjustors (ranked):
  - #1 *Atlas* PLOS[4] group
  - #2 Race
  - #3 Principal diagnosis group
- Significance test: none

[1] The *"forward step-wise"* statistical method was used to determine the best risk adjustor factors for each clinical condition.
[2] Age cohorts as defined by the PA Department of Health: 18 yr – 19 yr; 20 yr – 44 yr; 45 yr – 64 yr
[3] Age cohorts as defined by the PA Department of Health and modified by PHC4: 28 days – 4 yr; 5 yr – 17 yr
[4] *Atlas* Predicted Length of Stay group
[5] *Atlas* Admission Severity Group
[6] Q-wave vs. non Q-wave

DESCRIPTION OF MISSING DATA

The outcome data presented in this report are derived from the PHC4 database. Table 4A lists the number and percent of facilities that submitted incomplete data. Table 4B lists specific facilities that did not submit data based on time period. It should be noted that all analyses of data presented in these tables (4A-4B) below are based on *all* inpatient discharges - before exclusions and before payor verification of the data. Tables 4C and 4D summarize the number of hospitalizations (following the removal of clinical exclusions) with missing ASG scores for hospitals and HMO plans, respectively.

Table 4A. Records Submitted by Facilities by Quarter

Time Period	*N,* Total Facilities[1]	*N,* Facilities Not Reporting[2]	% Facilities Not Reporting
Quarter 3, 1998	200	2	1.0
Quarter 4, 1998	198	2	1.0
Quarter 1, 1999	197	2	1.0
Quarter 2, 1999	196	4	2.0

[1] The total number of facilities is shown as changing over time due to circumstances in which a facility changed status (e.g., changed from acute care status) or underwent a merger.
[2] Six facilities did not report data (see Table 4B below)

Table 4B. Facilities that Submitted Incomplete Data during Study Period

Facility Name	*N*[1], Quarter 3, 1998	*N*[1], Quarter 4, 1998	*N*[1], Quarter 1, 1999	*N*[1], Quarter 2, 1999	Total *N*[1]
• Lock Haven Hospital	647	687	715	0	2049
• Ashland Regional Medical Center	676	672	747	0	2095
• Chambersburg Hospital	0	2412	2619	2609	7640
• Charles Cole Memorial Hospital	659	0	0	614	1273
• Kensington Hospital	0	0	86	0	86
• Tyrone Hospital	365	341	0	0	706

[1] Refers to the number of records submitted

Table 4C. Hospitals Submitting Records† with Missing ASG Scores

Hospital	Adult Asthma		Pediatric Asthma		AMI		Heart Failure		Hysterectomy		TOTAL	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
All Facilities	**85**	**4.19**	**61**	**5.10**	**93**	**2.91**	**104**	**5.89**	**188**	**3.09**	**531**	**3.72**
Jefferson Hospital/Pittsburgh	28	33.73	2	50.00	19	35.19	15	45.45	6	37.50	70	36.84
Mercy of Pittsburgh	5	25.00	1	6.25	15	27.27	5	29.41	14	26.92	40	25.00
Saint Christopher Children	0	0.00	39	66.10	0	0.00	0	0.00	0	0.00	39	66.10
City Avenue	4	40.00	0	0.00	2	100.00	12	70.59	16	45.71	34	53.13
Bloomsburg	3	42.86	0	0.00	6	60.00	3	75.00	18	62.07	30	57.69
Medical College of PA	6	37.50	1	50.00	2	20.00	17	68.00	2	25.00	28	45.90
PA Hosp Univ PA Health System	1	20.00	0	0.00	2	25.00	4	30.77	20	19.80	27	21.26
Elkins Park	0	0.00	0	0.00	1	50.00	1	100.00	24	58.54	26	56.52
Temple University	4	23.53	0	0.00	6	23.08	7	12.96	8	20.51	25	18.38
Brandywine	0	0.00	0	0.00	3	17.65	3	50.00	10	37.04	16	29.09
Warminster	1	20.00	0	0.00	5	62.50	3	27.27	7	43.75	16	40.00
Graduate	4	25.00	0	0.00	3	37.50	4	28.57	1	10.00	12	25.00
Mercy of Scranton	1	33.33	0	0.00	0	0.00	2	50.00	8	50.00	11	26.83
Holy Spirit	1	6.25	0	0.00	0	0.00	1	9.09	8	27.59	10	13.16
Hospital of University of PA	0	0.00	0	0.00	1	5.56	5	15.15	4	8.33	10	8.70
MCMC Mercy of Philadelphia	2	22.22	0	0.00	3	27.27	4	17.39	1	12.50	10	19.61
Childrens Hospital of Philadelphia	0	0.00	9	5.59	0	0.00	0	0.00	0	0.00	9	5.45
Suburban General Norristown	2	33.33	0	0.00	1	12.50	0	0.00	4	28.57	7	20.59
Community Hospital Lancaster	0	0.00	0	0.00	1	33.33	0	0.00	6	15.79	7	14.89
Parkview	4	21.05	0	0.00	0	0.00	1	20.00	2	50.00	7	22.58
Saint Joseph's Hospital	2	50.00	0	0.00	1	100.00	1	25.00	2	66.67	6	50.00
Presbyterian Medical Ctr U of PA	1	5.26	0	0.00	3	6.82	2	6.90	0	0.00	6	6.45
Saint Francis Medical Center	2	14.29	0	0.00	1	1.69	1	4.00	2	2.50	6	3.35
Frankford Hospital City of Phila	2	4.00	0	0.00	2	5.56	1	2.70	0	0.00	5	3.01
Penn State (Hershey)	0	0.00	3	15.00	0	0.00	1	3.57	1	1.59	5	3.29
Millcreek Community	2	33.33	0	0.00	1	14.29	0	0.00	2	18.18	5	17.86
Jeanes	1	4.35	0	0.00	0	0.00	1	8.33	2	4.65	4	4.40
Germantwn Hsp & Com Hlth Serv	1	5.56	0	0.00	0	0.00	2	11.11	1	9.09	4	7.27
Warren General	0	0.00	0	0.00	1	20.00	0	0.00	3	75.00	4	36.36

Table 4C. Hospitals Submitting Records[†] with Missing ASG Scores continued

Hospital	Adult Asthma		Pediatric Asthma		AMI		Heart Failure		Hysterectomy		TOTAL	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Mercy Fitzgerald	2	11.11	0	0.00	1	7.14	0	0.00	0	0.00	3	2.80
Episcopal	0	0.00	0	0.00	1	25.00	0	0.00	2	33.33	3	21.43
Main Line Lankenau	1	7.69	0	0.00	1	4.35	1	5.56	0	0.00	3	3.75
Mercy Community	1	14.29	0	0.00	0	0.00	2	28.57	0	0.00	3	11.11
Jeannette District Memorial	0	0.00	0	0.00	0	0.00	1	6.25	2	3.33	3	2.88
Pinnacle Health	1	4.17	0	0.00	2	2.25	0	0.00	0	0.00	3	0.77
Main Line Bryn Mawr	0	0.00	0	0.00	2	13.33	1	12.50	0	0.00	3	3.80
Methodist	0	0.00	0	0.00	1	8.33	0	0.00	1	2.50	2	2.90
Community Medical Center Scranton	0	0.00	0	0.00	1	3.13	0	0.00	1	1.47	2	1.32
Temple U Childrens Med Ctr	0	0.00	2	10.53	0	0.00	0	0.00	0	0.00	2	10.53
Delaware County Memorial	0	0.00	0	0.00	1	5.88	0	0.00	1	2.50	2	2.30
Crozer- Chester Medical Ctr	0	0.00	0	0.00	1	1.79	0	0.00	1	1.15	2	0.80
Abington Memorial	0	0.00	1	2.86	0	0.00	0	0.00	1	0.94	2	0.77
WVHCS	0	0.00	1	11.11	0	0.00	0	0.00	1	0.78	2	0.81
Mercy of Wilkes-Barre	0	0.00	0	0.00	0	0.00	2	15.38	0	0.00	2	2.30
Saint Francis New Castle	0	0.00	0	0.00	0	0.00	0	0.00	1	3.23	1	1.96
Albert Einstein Medical Ctr	0	0.00	0	0.00	0	0.00	0	0.00	1	2.22	1	0.63
Kane Community	0	0.00	0	0.00	0	0.00	0	0.00	1	7.69	1	6.67
York	0	0.00	0	0.00	1	2.44	0	0.00	0	0.00	1	0.42
UPMC Presbyterian	1	3.85	0	0.00	0	0.00	0	0.00	0	0.00	1	0.79
Temple East- NE Division	0	0.00	0	0.00	0	0.00	0	0.00	1	11.11	1	2.50
Childrens Hospital Pittsburgh	0	0.00	1	0.58	0	0.00	0	0.00	0	0.00	1	0.57
Carlisle	0	0.00	0	0.00	0	0.00	1	11.11	0	0.00	1	1.59
Uniontown	0	0.00	0	0.00	0	0.00	0	0.00	1	10.00	1	4.35
Doylestown	0	0.00	0	0.00	1	5.56	0	0.00	0	0.00	1	1.37
UPMC Passavant	1	2.33	0	0.00	0	0.00	0	0.00	0	0.00	1	0.60
Altoona	0	0.00	0	0.00	0	0.00	0	0.00	1	1.89	1	0.93
North Penn	1	5.56	0	0.00	0	0.00	0	0.00	0	0.00	1	1.67
Temple Lower Bucks	0	0.00	1	12.50	0	0.00	0	0.00	0	0.00	1	1.08
Somerset Center for Health	0	0.00	0	0.00	1	16.67	0	0.00	0	0.00	1	3.23

[†] Includes only those hospitalizations that remain following the removal of excluded hospitalizations (i.e., hospitalizations meeting the exclusion criteria).

Table 4D. HMO Hospitalizations Excluded due to Missing ASG Scores: A Reflection of Network Hospitals Submitting Records[†] with Missing ASG Scores

	Adult Asthma		Pediatric Asthma		AMI		Heart Failure		Hysterectomy		TOTAL	
HMO Plan	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Aetna/US Healthcare	9	2.57	4	1.73	16	3.14	21	6.69	54	5.83	104	4.46
Alliance	1	4.17	0	0.00	0	0.00	0	0.00	1	0.67	2	0.77
CIGNA	1	3.70	1	5.56	2	9.09	0	0.00	1	1.72	5	3.68
First Priority	0	0.00	1	1.96	2	1.14	2	2.30	4	1.05	9	1.13
Health America HMO	4	3.23	1	1.79	6	3.45	6	5.36	2	0.52	19	2.24
Health America POS	2	2.60	0	0.00	1	0.59	2	4.08	7	1.97	12	1.75
Health Central	0	0.00	1	5.26	0	0.00	0	0.00	0	0.00	1	0.48
HealthGuard	0	0.00	1	3.13	1	1.39	0	0.00	4	2.34	6	1.81
Horizon	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Keystone Central	2	2.04	1	2.22	3	1.81	2	2.94	8	1.81	16	1.96
Keystone East	28	7.22	43	14.68	23	5.94	48	11.79	66	8.58	208	9.27
Keystone West	7	4.79	0	0.00	5	2.07	3	2.14	4	0.87	19	1.80
Penn State/Geisinger	2	2.78	0	0.00	3	1.85	1	1.92	13	4.71	19	3.18
PruCare	1	3.45	3	10.34	3	6.38	1	4.35	1	1.27	9	4.35
QualMed East	2	6.45	1	7.69	2	9.09	7	19.44	2	3.64	14	8.92
QualMed West	1	9.09	0	0.00	0	0.00	0	0.00	0	0.00	1	2.08
Select Blue	21	4.90	3	1.32	24	2.65	9	2.44	20	1.48	77	2.35
UPMC	4	6.67	1	4.17	2	4.88	2	6.90	1	0.93	10	3.83
HMO	85	4.19	61	5.10	93	2.91	104	5.89	188	3.09	531	3.72
TRADITIONAL FEE-FOR-SERVICE	54	4.91	18	3.12	64	2.23	61	4.24	101	1.93	298	2.66
OTHER	404	6.62	694	14.24	219	3.60	609	6.88	330	4.35	2256	6.74
STATEWIDE	543	5.88	773	11.63	376	3.09	774	6.42	619	3.28	3085	5.23

[†] Includes only those hospitalizations that remain following the removal of excluded hospitalizations (i.e., hospitalizations meeting the exclusion criteria).

CLINICAL CONDITIONS

ASTHMA

Inclusion Criteria

Adult (ages 18-64 yr) and pediatric (ages 0-17 yr) cases are analyzed separately. Cases are included in the data analysis if they include diagnoses/treatment for the clinical condition of asthma, as defined by one of the following ICD.9.CM codes (as the principal diagnosis): 493.00, 493.01, 493.10, 493.11, 493.20, 493.21, 493.90, 493.91 (see Appendix A: Description of Study Population by ICD.9.CM Code).

Note, of the 15,981 asthma hospitalizations submitted to PHC4 for inclusion in the *Managed Care Performance Report*, 13 records were identified as duplicates. As a result, 15,968 asthma hospitalizations (statewide; 9,295 adult + 6,673 pediatric; prior to the removal of excluded records) were studied in this report.

Data Analyzed

For adult asthma, the main data component that is analyzed is the index hospitalization only. Table 5A lists the hospitalizations that are excluded at the outset because of record errors (e.g., nonsensical dates). Due to these errors, linkage of contiguous hospitalizations into an episode of care could not be accomplished.

Table 5B lists the index asthma hospitalizations that are used to determine *hospitalization rate* for adult patients. Only index hospitalizations are used to determine *hospitalization rate*. Contiguous hospitalizations, although important for other outcome measures, are not accounted for in the *hospitalization rate* analysis since this analysis acts to tally the number of patient episodes. If every single hospitalization was included in the *hospitalization rate* analyses, misleadingly high rates of hospitalized care would be documented.

Table 5B shows that the total number of hospitalizations in PHC4's statewide database for adult asthma patients is different from the number of index hospitalizations since several contiguous hospitalizations (transfers) may comprise a single episode of care (which is initiated by a single index hospitalization). More specifically, the number of hospitalizations in the PHC4's database consists of index hospitalizations and non-index hospitalizations that are embedded within episodes. This table is shown primarily to account for all hospitalizations in the PA reference/statewide database and to compare this number to the total number of hospitalizations (index only) used to determine *hospitalization rate* for adult asthma. The embedded hospitalizations are not excluded hospitalizations; they are fixed within an episode. Clinical information (such as date of discharge) taken from the embedded hospitalizations is needed for readmission analysis. Specifically, the date of discharge of the last hospitalization (which may *not* be an index asthma hospitalization) in the episode is used as the reference date for hospital readmissions (that are defined to begin within 1-90 days of the reference date).

The value in Table 5B that corresponds to the "total index hospitalizations" is the same as that shown for the "total hospitalizations before exclusions" value represented in the tables that list the adult asthma exclusion criteria (Tables 5D, 5F and 5H). These two terms are used interchangeably since the number of index hospitalizations is equivalent to the number of adult asthma episodes.

For pediatric patients, the main data component analyzed is *only* a single hospitalization for asthma (since hospital transfers can not be linked together due to lack of SSNs for a considerable proportion of the pediatric population). Table 5C lists the pediatric asthma hospitalizations excluded prior to any analyses. These records were excluded due to problems involving invalid notation for gender (because they could not be incorporated into PHC4's calculation for *hospitalization rate*).

Table 5A: Linkage of Hospitalizations into Episodes of Care for Adult Asthma: Hospitalizations Excluded

	HMO Total Hospitalizations		STATEWIDE Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations *before* exclusions	2,042	100.0	9,295	100.0
Exclusions				
❖ Problematic records †	0	0.0	2	<0.1
Hospitalizations retained for analysis	2,042	100.0	9,293	99.9

† Hospitalizations lacking clear identifying characteristics (e.g., records with invalid notation for sex or nonsensical dates; case in which a patient was recorded as having died before his/her last hospitalization)

Table 5B: Number of Hospitalizations versus Number of Index Hospitalizations for Adult Asthma

	HMO Total Hospitalizations		STATEWIDE Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations from statewide database	2,042	100.0	9,293	100.0
Embedded hospitalizations				
❖ Asthma hospitalizations that were not index hospitalizations †	6	0.3	28	0.3
Total index hospitalizations	2,036	99.7	9,265	99.7

† See text for explanation.

Table 5C: Records Excluded Prior to Any Analyses for Pediatric Asthma

	HMO Total Hospitalizations		STATEWIDE Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations *before* exclusions	1,200	100.0	6,673	100.0
Exclusions				
❖ Problematic records [†]	0	0.0	1	<0.1
Total hospitalizations remaining in analysis	1,200	100.0	6,672	99.9

[†] Hospitalizations lacking clear identifying characteristics (e.g., records with unknown or invalid notation for sex)

Outcome Measures and Exclusion Criteria

Hospitalization Rate (age- and sex-adjusted). This measure is reported separately for adult and pediatric patients. The *hospitalization rate* is shown for each HMO using the total number of asthma index hospitalizations per 10,000 adult/pediatric members. **For adults, the index hospitalization is counted in the hospitalization rate; for pediatric patients, the single asthma hospitalization is used.**

Calculation of the actual asthma *hospitalization rate* for an individual HMO plan incorporates the total number of index/single (for adult/pediatric) hospitalizations by the plan in the numerator and the total number of enrollees for the plan in the denominator. HMO benchmark rates for each age/sex combination (cell) are determined from *all data combined* (i.e., HMO hospitalizations under the age of 65, pooled); the HMO benchmark serves as a comparison for each of the HMO plans. Hospitalizations that are excluded from the *hospitalization rate* analysis for asthma are listed in Tables 5D (adult) and 5E (pediatric).

Table 5D: Exclusions from "Hospitalization Rate" Analysis for Adult Asthma

	HMO Total Hospitalizations		STATEWIDE Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations *before* exclusions	2,036	100.0	9,265	100.0
Exclusions:				
❖ Hospitalizations that were clinically complex:				
Tracheostomy [1] procedure performed	1	0.1	7	0.1
Lung cancer [2]	3	0.2	19	0.2
Metastatic cancers from other body systems [3]	2	0.1	8	0.1
Total Exclusions	6	0.3	34	0.4
Total hospitalizations remaining in analysis	2,030	99.7	9,231	99.6

[1] ICD.9.CM procedure codes 31.1, 31.21, 31.29
[2] Lung cancers involving primary site, secondary site (metastatic), uncertain behaviors, in situ cancers, or cancer of non-specific site; ICD.9.CM codes 162.2-162.9, 197.0, 231.2, 235.7, 239.1
[3] ICD.9.CM codes 196.0-199.1

Table 5E: Exclusions from "Hospitalization Rate" Analysis for Pediatric Asthma

	HMO Total Hospitalizations		STATEWIDE Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations *before* exclusions	1,200	100.0	6,672	100.0
Exclusions:				
❖ Neonates (age < 28 days)	0	0.0	2	<0.1
❖ Hospitalizations that were clinically complex:				
Lung cancer[1]	0	0.0	1	<0.1
Metastatic cancers from other body systems[2]	0	0.0	3	<0.1
Total Exclusions	0	0.0	6	0.1
Total hospitalizations remaining in analysis	1,200	100.0	6,666	99.9

[1] Lung cancers involving primary site, secondary site (metastatic), uncertain behaviors, in situ cancers, or cancer of non-specific site; ICD.9.CM codes 162.2-162.9, 197.0, 231.2, 235.7, 239.1
[2] ICD.9.CM codes 196.0-199.1

Lengths of Stay (risk-adjusted) analyses are conducted separately for adult and pediatric patients. The inpatient *length of stay* outcome measure is a valuable indicator of the time spent under a provider's care. It is calculated from the index hospitalization (in which asthma is the principal diagnosis) only, beginning with the date of admission and ending with the date of discharge of the index hospitalization. Therefore, **for length-of-stay (for pediatric and adult patients) a single/index hospitalization is used**. Hospitalizations that are excluded from the risk-adjusted *length of stay* analysis for asthma are listed in Tables 5F (adult) and **5G** (pediatric).

Table 5F: Exclusions from "Length of Stay" (LOS) Analysis for Adult Asthma

	HMO Total Hospitalizations		LOS	STATEWIDE Total Hospitalizations		LOS
	N	*% of Total*	*Ave.*	*N*	*% of Total*	*Ave.*
Total hospitalizations *before* exclusions	2,036	100.0	3.4	9,265	100.0	3.5
Exclusions:						
❖ Hospitalization rate exclusions	6	0.3	5.0	34	0.4	9.6
❖ Death in hospital	0	0.0	-	10	0.1	7.5
❖ Hospitalizations with missing *Atlas* PLOS scores	85	4.2	3.1	541	5.8	3.1
❖ Outlier[1]/invalid[2] or missing LOS	6	0.3	22.2	40	0.4	21.2
Total Exclusions	97	4.8	4.4	625	6.8	4.7
Total hospitalizations remaining in analysis	1,939	95.2	3.3	8,640	93.3	3.4

[1] Those LOS values which are greater than the 99.5th percentile (i.e., 15 days length of stay).
[2] LOS value < 0

Table 5G: Exclusions from "Length of Stay" (LOS) Analysis for Pediatric Asthma

	HMO			STATEWIDE		
	Total Hospitalizations		LOS	Total Hospitalizations		LOS
	N	*% of Total*	*Ave.*	*N*	*% of Total*	*Ave.*
Total hospitalizations *before* exclusions	1,200	100.0	2.0	6,672	100.0	2.2
Exclusions:						
❖ Hospitalization rate exclusions	0	0.0	-	6	0.1	2.7
❖ Hospitalizations with missing *Atlas* PLOS scores	61	5.1	2.0	774	11.6	2.1
❖ Outlier[1]/invalid[2] or missing LOS	4	0.3	11.3	29	0.4	14.6
Total Exclusions	65	5.4	2.6	809	12.1	2.6
Total hospitalizations remaining in analysis	1,135	94.6	2.0	5,863	87.9	2.1

[1] Those LOS values which are greater than the 99.5th percentile (i.e., 10 days length of stay).
[2] LOS value < 0

Readmission Rate (risk-adjusted) is calculated for adult asthma only. Because pediatric cases frequently lack SSN identification, potential readmission hospitalizations can not be linked to previous hospitalizations. Thus, readmission rate analysis is not reported for pediatric asthma cases.

For *readmission rate,* any return hospitalization for respiratory-related acute care (MDC 4) within 1-90 days of discharge from an acute care facility in Pennsylvania is used. For multiple-hospitalization episodes, the discharge date of the last hospitalization (which may *not* be asthma-related) in the asthma episode is used as the start point for counting the 90 days. The principal diagnosis of the return hospitalization must be respiratory-related in order to be included in the *readmission rate* analysis.

Calculation of the readmission rate incorporates the observed number of asthma-related readmissions in the numerator and the number of asthma index hospitalizations by HMO plan in the denominator. In the *Managed Care Performance Report* the readmission rate is reported as a *percentage*. Exclusion criteria for *readmission rate* are listed in Table 5H.

Table 5H: Exclusions from "Readmission Rate" Analysis for Adult Asthma

	HMO		STATEWIDE	
	Total Hospitalizations		Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations *before* exclusions	2,036	100.0	9,265	100.0
Exclusions:				
❖ LOS analysis exclusions	97	4.8	625	6.8
❖ Invalid SSN	22	1.1	161	1.7
❖ Invalid dates/gender	0	0.0	3	<0.1
❖ Inconsistent SSN/gender/DOB	14	0.7	91	0.1
Total Exclusions	133	6.5	880	9.5
Total hospitalizations remaining in analysis	1,903	93.5	8,385	90.5

ACUTE MYOCARDIAL INFARCTION

Inclusion Criteria

Cases who were assigned a principal diagnosis (in the initial index hospitalization) of one of the ICD.9.CM codes for AMI (i.e., 410.x1, where x = 0 – 9 delineates the location of the infarction within the heart, and the fifth digit of "1" delineates the initial episode of care for that AMI; see Appendix A: Description of Study Population by ICD.9.CM Code) are included in the analyses.

Note, of the 15,110 AMI hospitalizations submitted to PHC4 for inclusion in the *Managed Care Performance Report*, 20 records were identified as duplicates. As a result, 15,090 AMI hospitalizations (statewide; prior to the removal of excluded records) were investigated in this report.

Data Analyzed

The care received by a patient following an AMI is comprehensive and typically involves several additional/intricately-related hospitalizations. Therefore, for this report, **the main data component analyzed consists of *all* acute care hospitalizations (regardless of principal diagnosis) that begin within 30 days of the admit date of the index AMI hospitalization or are *linked by date* to a hospitalization beginning within 30 days of the admit date of the index AMI hospitalization.** This unique methodology is meant to provide for a complete depiction of an individual patient's hospitalization experience for a single AMI. Thus, the analyses for AMI outcomes include data for single patients only. For any one patient, only hospitalizations associated with the first AMI hospitalization are included in the outcome analyses. That is, if a patient encounters two or more AMI hospitalizations within the one year study period, only the hospitalizations associated with the first index hospitalization are analyzed in this study. Those AMI hospitalizations occurring after the 30-day period that are not contiguous with any other hospitalization beginning within the 30-day period are excluded (see Table 6A). In addition, Table 6A lists (as exclusions) those index AMI hospitalizations that are contiguous with AMI hospitalizations occurring prior to the study period. Table 6A also lists the AMI hospitalizations excluded due to errors in the records (e.g., problematic records in which a patient was listed as having died in more than one hospitalization).

Table 6B 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 AMI hospitalization are studied as a unit in the outcomes analyses. Table 6B lists the non-index hospitalizations that are embedded into a single unit (to represent individual patients). Clinical information from each individual hospitalization (index and non-index) is utilized for the following analyses: *in-hospital mortality rate*, *average number of days hospitalized*, and cardiac procedure rates (i.e., *catheterization rate*, *CABG rate*, *PTCA/stent rate*). For the cardiac procedure rates and *in-hospital mortality rate* analyses, the death or the procedure, respectively, must occur within 30 days of the admission date of the index AMI in order to be included in the analysis. For *length of stay* analysis, all hospitalizations beginning no more than 30 days of the admit date of the index AMI hospitalization are used to determine the total days hospitalized. The value that corresponds to the "total index hospitalizations" as shown in Table 6B is the same as that shown for the "total hospitalizations before exclusions" value represented in the tables that list the exclusion criteria (Tables 6C – 6E).

Table 6A: Linkage of Hospitalizations to Patients for AMI Analysis: Hospitalizations Excluded

	HMO Total Hospitalizations		STATEWIDE Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations *before* exclusions	3,977	100.0	15,090	100.0
Exclusions				
❖ Problematic records [1]	2	<0.1	2	<0.1
❖ Index AMI hospitalizations that are contiguous with AMI hospitalizations occurring prior to the study period	7	0.2	30	0.2
❖ Hospitalizations occurring beyond 30 days from the initial index hospitalization[2]	75	1.9	335	2.2
Total exclusions	84	2.1	367	2.4
Hospitalizations retained for analysis	3,893	97.9	14,723	97.6

[1] Hospitalizations lacking clear identifying characteristics (e.g., record with an admit date and/or discharge date that was so substantially erroneous as to prevent identification of at least one episode of care; case in which a single patient was recorded as having died more than once)

[2] AMI hospitalizations that occur after the 30-day period *and* are not contiguous with any other hospitalization beginning within the 30-day period.

Table 6B: Number of Hospitalizations versus Number of Index Hospitalizations Studied per AMI Patient

	HMO Total Hospitalizations		STATEWIDE Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations from statewide database	3,893	100.0	14,723	100.0
❖ Non-index AMI hospitalizations that were embedded into "30-day episode"	685	17.6	2,515	17.1
Total index hospitalizations analyzed	3,208	82.4	12,208	82.9

Outcome Measures and Exclusion Criteria

Hospitalization Rate (age/sex-adjusted; per 10,000 members) is reported for individuals 18 – 64 years of age. This measure is determined for each HMO using the total number of patients in the AMI analysis. Therefore, ***all*** **hospitalizations associated with an individual patient are collectively referred to as a single data unit for hospitalization rate analysis.**

The actual *hospitalization rate* for an individual HMO plan for AMI incorporates the total number of AMI patients by the plan in the numerator and the total number of enrollees for the plan in the denominator. HMO benchmark rates for each age/sex combination (cell) are

determined from all HMO AMI patients under the age of 65 combined; the HMO benchmark serves as a comparison for each of the HMO plans.

Hospitalizations that are excluded from the *hospitalization rate* analysis for AMI are listed in Table 6C.

Table 6C: Exclusions from "Hospitalization Rate" Analysis for AMI

	HMO Total Hospitalizations		STATEWIDE Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations *before* exclusions	3,208	100.0	12,208	100.0
Exclusions:				
❖ Age < 18 years	1	<0.1	7	0.1
❖ Age > 64 years[1]	0	0.0	1	<0.1
❖ Hospitalizations that were clinically complex:				
Transplants[2]	1	<0.1	11	0.1
Metastatic cancer[3]	10	0.3	51	0.4
Total Exclusions	12	0.4	70	0.6
Total hospitalizations remaining in analysis	3,196	99.6	12,138	99.4

[1] These hospitalizations were excluded following the resolution of birth dates after the verification process. Generally, hospitalizations involving patient 65 years and older were excluded before the verification process.
[2] Heart transplants (ICD.9.CM procedure code 37.5) and heart/lung transplants (ICD.9.CM procedure code 33.6) occurring in an AMI hospitalization
[3] Cancer was listed in an AMI hospitalization; metastatic cancer ICD.9.CM codes 196.0-199.1

In-Hospital Mortality Rate (risk-adjusted). The care received by a patient following an AMI is comprehensive and typically involves several additional/intricately-related hospitalizations. Therefore, **any acute care hospitalization ending in death (regardless of principal diagnosis), where the death (discharge status "20" listed in the record) occurred no more than 30 days after the admit date of the index AMI hospitalization, is included in the in-hospital mortality rate analysis** The actual *in-hospital mortality rate* for AMI is calculated by dividing the total number of deaths (occurring within 30 days of the admit date of the index hospitalization) for AMI patients in the study for each HMO plan by the total number of AMI patients per plan. In the *Managed Care Performance Report*, the *in-hospital mortality rate* is reported as a percentage. The exclusions to the analysis of *in-hospital mortality rate* for AMI are listed below in Table 6D.

Table 6D: Exclusions from "In-Hospital Mortality Rate" Analysis for AMI

	HMO			STATEWIDE		
	Total Hospitalizations		Mortality	Total Hospitalizations		Mortality
	N	*% of Total*	**%**	*N*	*% of Total*	**%**
Total hospitalizations *before* exclusions	3,208	100.0	2.7	12,208	100.0	3.8
Exclusions:						
❖ Hospitalization rate exclusions	12	0.4	8.3	70	0.6	20.0
❖ Hospitalizations with a missing *Atlas* ASG score in index hospitalization	93	2.9	2.2	376	3.1	3.2
❖ Invalid SSN†	43	1.3	0.0	282	2.3	0.0
❖ Invalid dates/gender†	2	0.1	0.0	4	<0.1	0.0
❖ Inconsistent SSN/gender/DOB†	34	1.1	0.0	188	1.5	0.0
Total Exclusions	184	5.7	1.6	920	7.5	2.8
Total hospitalizations remaining in analysis	3,024	94.3	2.8	11,288	92.5	3.8

† These exclusions were specific to surviving patients. Surviving patients were excluded since it was indeterminable (due to invalid SSN, dates, gender, etc.) whether or not these patients were hospitalized at another time following the index AMI hospitalization.

Other cardiac procedures associated with any single AMI patient.

Cardiac Catheterization Percentage: The cardiac catheterization procedure (ICD.9.CM codes 37.22 or 37.23) must be performed (in any hospitalization, regardless of principal diagnosis) within 30 days of (or 3 days prior to) the index hospitalization admission date for an AMI. Calculation of the *catheterization rate* incorporates the frequency of catheterization procedures (occurring for a single AMI patient), by plan in the numerator and the number of AMI patients for each plan in the denominator. Note, when a procedure code for a diagnostic catheterization is not present in an AMI record, it is assumed that the said procedure was in fact performed in conjunction with PTCA/stent procedures and CABG surgeries since all such cases require a diagnostic catheterization in order to undergo therapeutic intervention/coronary revascularization.

PTCA/Stent Percentage: The codes associated with PTCA (percutaneous transluminal coronary angioplasty) include 36.01, 36.02, 36.05. The code assigned to a stent procedure is 36.06 (coded along with 36.01, 36.02, or 36.05). To be included in the analyses, these procedures must be performed within 30 days of the index hospital admission for an AMI. Calculation of this rate incorporates the frequency of the procedures (occurring in any individual patient) for individual HMO plans in the numerator and the number of AMI patients per plan in the denominator.

Coronary Artery Bypass Graft (CABG) Percentage: The codes associated with bypass surgery rate include 36.10 – 36.17, 36.19. One or more of these procedure codes must be present (in any hospitalization) within the AMI episode. The CABG procedure must be performed within 30 days of the index hospitalization admission date for an AMI. Calculation of the *bypass surgery rate* incorporates 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 AMI patients by plan in the denominator.

Average Number of Days Hospitalized (risk-adjusted). The average number of days hospitalized for individual AMI patients in the study are reported in place of *length of stay* as an indicator of the time spent in the hospital(s) for AMI treatment. **The average number of *days hospitalized* for AMI patients consists of the total time spent in the hospital or the sum of individual hospitalizations (principal diagnosis need not be limited to AMI/MDC 5) that begin no more than 30 days of the admit date of the index AMI hospitalization.** The exclusions to the *average number of days hospitalized* analysis for AMI are listed in Table 6E.

Table 6E: Exclusions from "Average Number of Days Hospitalized" Analysis for AMI

	HMO			STATEWIDE		
	Total Hospitalizations		Days	Total Hospitalizations		Days
	N	*% of Total*	*Ave.*	*N*	*% of Total*	*Ave.*
Total hospitalizations *before* exclusions	3,208	100.0	4.6	12,208	100.0	4.9
Exclusions:						
❖ In-hospital mortality exclusions	184	5.7	5.4	920	7.5	6.5
❖ Death in hospital within 30 days[1]	84	2.6	4.8	433	3.6	4.5
❖ Death in hospital after 30 days but within an episode[2]	5	0.2	36.6	25	0.2	42.3
❖ Outliers[3]/Missing or Invalid[4] LOS	7	0.2	37.4	53	0.4	36.6
Total Exclusions	280	8.7	6.6	1,431	11.7	7.6
Total hospitalizations remaining in analysis	2,928	91.3	4.4	10,777	88.3	4.6

[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 > 38.
[4] LOS value < 0

HEART FAILURE

Inclusion Criteria

Cases who were assigned one of the following codes (related to heart failure) as the principal diagnosis are included in the analyses: 398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.9 (see Appendix A: Description of Study Population by ICD.9.CM Code).

Note, of the 12,774 heart failure hospitalizations submitted to PHC4 for inclusion in the *Managed Care Performance Report*, 19 records were identified as duplicates. As a result, 12,755 heart failure hospitalizations (statewide; prior to the removal of excluded records) were studied in this report.

Data Analyzed

For heart failure, the main data component analyzed is all heart failure-related hospitalizations within an episode of care. Table 7A lists the hospitalizations that are excluded at the outset due to errors in the records that preclude the linkage of contiguous hospitalizations into an episode of care. In particular, those heart failure hospitalizations occurring within the study period that are contiguous with heart failure hospitalizations (transfers) occurring pre- or post-study period are excluded. That is, the hospitalizations that are contiguous to hospitalizations that precede or follow the period of study are not truly part of the study period and are consequently excluded (see Table 7A).

Table 7B shows that the total number of hospitalizations in the statewide database for heart failure patients is different from the number of index hospitalizations because several hospitalizations (transfers) may comprise a single episode of care. This table is shown to account for all hospitalizations in the reference database that are not used in the hospitalization rate analysis. The table lists the hospitalizations that are embedded into a single heart failure episode of care. Clinical information (dates of discharge or deaths) from the embedded hospitalizations are used in the length of stay, readmission rate, and in-hospital mortality rate analyses for heart failure.

The value in Table 7B that corresponds to the “total index hospitalizations” is the same as that shown for the “total hospitalizations before exclusions” value found in Tables 7C-7F.

Table 7A: Linkage of Hospitalizations into Episodes of Care for Heart Failure: Hospitalizations Excluded

	HMO Total Hospitalizations		STATEWIDE Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations *before* exclusions	1,879	100.0	12,755	100.0
Exclusions				
❖ Problematic records [1]	0	0.0	12	0.1
❖ Heart failure hospitalizations that, in effect, begin prior to the study period[2]	1	0.1	8	0.1
❖ Heart failure hospitalizations that, in effect, end after the study period[2]	1	0.1	4	<0.1
Total exclusions	2	0.1	24	0.2
Hospitalizations retained for analysis	1,877	99.9	12,731	99.8

[1] For example, patient with noncontiguous heart failure hospitalizations in the same episode or patient who "died" more than once or "died" before his/her last hospitalization

[2] Heart failure hospitalizations *contiguous* with heart failure hospitalizations occurring prior to or following the study period. See text for explanation.

Table 7B: Number of Hospitalizations versus Number of Index Hospitalizations for Heart Failure

	HMO Total Hospitalizations		STATEWIDE Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations from statewide database	1,877	100.0	12,731	100.0
❖ Heart failure hospitalizations that were embedded into "heart failure episode"	37	2.0	217	1.7
Total index hospitalizations	1,840	98.0	12,514	98.1

Outcome Measures and Exclusion Criteria

Hospitalization Rate (age/sex-adjusted; per 10,000 members) is reported for individuals age 18 - 64. This measure is determined for each HMO using the total number of index hospitalizations for heart failure. Thus, **only the index hospitalization is counted in the hospitalization rate.**

The actual *hospitalization rate* for an individual HMO plan for heart failure incorporates the total number of index hospitalizations by the plan in the numerator and the total number of enrollees for the plan in the denominator. HMO benchmark rates for each age/sex combination (cell) are determined from all HMO hospitalizations under the age of 65 combined; the HMO benchmark serves as a comparison for each of the HMO plans. Hospitalizations that are excluded from the *hospitalization rate* analysis for heart failure are listed in Table 7C.

Table 7C: Exclusions from "Hospitalization Rate" Analysis for Heart Failure

	HMO Total Hospitalizations		STATEWIDE Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations *before* exclusions	1,840	100.0	12,514	100.0
Exclusions:				
❖ Age < 18 years	7	0.4	63	0.5
❖ Age > 64 years[1]	0	0.0	2	<0.1
❖ Hospitalizations that were clinically complex:				
Heart, kidney, heart/lung transplants[2]	11	0.6	86	0.7
Metastatic cancer[3]	24	1.3	118	0.9
Total Exclusions	42	2.3	269	2.2
Total hospitalizations remaining in analysis	1,798	97.7	12,245	97.9

[1] These hospitalizations were excluded following the resolution of birth dates after the verification process. Generally, hospitalizations involving patient 65 years and older were excluded before the verification process.
[2] Transplants occurring in a heart failure hospitalization; ICD.9.CM procedure codes 33.50-33.52, 33.6-37.5, 55.61, 55.69
[3] Cancer was listed in a heart failure hospitalization; metastatic cancer ICD.9.CM codes 196.0-199.1

In-Hospital Mortality Rate (risk-adjusted; reported as a percentage) is calculated for deaths in heart failure-related hospitalizations occurring within an episode. Specifically, **this rate is derived from the number of deaths (discharge status "20" listed in a heart failure hospitalization within an episode) for each managed care organization.** The *in-hospital mortality rate* for heart failure is determined by dividing the total number of deaths associated with heart failure per HMO plan by the total number of index hospitalizations (for heart failure) per plan. Listed below (Table 7D) are the exclusions to the analysis of *in-hospital mortality rate* for heart failure.

Table 7D: Exclusions from "In-Hospital Mortality Rate" Analysis for Heart Failure

	HMO			STATEWIDE		
	Total Hospitalizations		Mortality	Total Hospitalizations		Mortality
	N	*% of Total*	**%**	*N*	*% of Total*	**%**
Total hospitalizations *before* exclusions	1,840	100.0	1.6	12,514	100.0	2.2
Exclusions:						
❖ Hospitalization rate exclusions	42	2.3	4.8	269	2.2	8.6
❖ Hospitalizations with missing *Atlas* ASG scores †	106	5.8	0.9	782	6.2	1.8
Total Exclusions	148	8.0	2.0	1,051	8.4	3.5
Total hospitalizations remaining in analysis	1,692	92.0	1.6	11,463	91.6	2.1

† Based on information in the index hospitalization

Length of Stay (risk-adjusted). **The inpatient *length of stay* (risk-adjusted) for heart failure analysis is derived from all heart failure hospitalizations that occur within an episode**. Thus, all heart failure hospitalizations (i.e., all corresponding lengths of stay) within

an episode are combined to yield the total length of stay for that episode. Listed below (Table 7E) are the exclusions to the *length of stay* analysis for heart failure.

Table 7E: Exclusions from "Length of Stay" (LOS) Analysis for Heart Failure

	HMO			STATEWIDE		
	Total Hospitalizations		LOS	Total Hospitalizations		LOS
	N	*% of Total*	*Ave.*	*N*	*% of Total*	*Ave.*
Total hospitalizations *before* exclusions	1,840	100.0	6.0	12,514	100.0	6.4
Exclusions:						
❖ In-hospital mortality rate exclusions	148	8.0	15.7	1,051	8.4	13.9
❖ Death in hospital[1]	27	1.5	11.4	238	1.9	14.7
❖ Outlier[2]/invalid[3] or missing LOS	6	0.3	68.3	56	0.4	74.4
Total Exclusions	181	9.8	16.8	1,345	10.8	16.6
Total hospitalizations remaining in analysis	1,659	90.2	4.9	11,169	89.2	5.1

[1] Refers to a death occurring in a heart failure hospitalization within the episode.
[2] Hospitalizations in which LOS > 38 days
[3] LOS value < 0

Readmission Rate (risk-adjusted). For heart failure analysis, ***readmission rate*** **is defined as any return hospitalization for heart failure within 1-90 days of discharge. For multiple-hospitalization episodes, the discharge date of the last hospitalization (which is not necessarily a heart failure hospitalization) in the episode is used.** The principal diagnosis of the return hospitalization must be heart failure in order to be included in the analysis.

Calculation of the readmission rate incorporates the observed number of readmissions (for heart failure) by HMO plan in the numerator and the number of index hospitalizations by HMO plan in the denominator. Exclusions to the analysis of *readmission rate* for heart failure are outlined in Table 7F.

Table 7F: Exclusions from "Readmission Rate" Analysis for Heart Failure

	HMO		STATEWIDE	
	Total Hospitalizations		Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations *before* exclusions	1,840	100.0	12,514	100.0
Exclusions:				
❖ Length of stay exclusions	181	9.8	1,345	10.8
❖ Death in hospital[†]	2	0.1	20	0.2
❖ Invalid SSN	20	1.1	151	1.2
❖ Inconsistent SSN/gender/DOB	13	0.7	155	1.2
Total Exclusions	216	11.7	1,671	13.4
Total hospitalizations remaining in analysis	1,624	88.3	10,843	86.6

[†] Refers to a death occurring in a non-heart failure hospitalization within the episode

HYSTERECTOMY

Inclusion Criteria

Hysterectomy procedures can be divided among abdominal and vaginal surgical approaches. Since each approach contributes to the outcome measure analyses in a significant and independent way, abdominal and vaginal hysterectomy cases are analyzed separately in this report. Collectively, these study populations include hospitalizations that are assigned a principal procedure code of hysterectomy or undergo a hysterectomy as a secondary procedure (listed as the *first* secondary procedure). The first secondary procedure is captured because occasionally when a hysterectomy is performed in conjunction with another female reproductive surgery, such as removal of the ovaries, it is coded in this position. The following ICD.9.CM procedure codes are used to define hysterectomy cases: 68.3, 68.4, 68.51, 68.59, 68.6, 68.7, 68.9 (see Appendix A: Description of Study Population by ICD.9.CM Code). Only "elective" hysterectomy procedures are examined in this report. Hysterectomies performed due to cancer, trauma of the female reproductive system, or other emergent reasons are not analyzed in this report.

Note, of the 21,426 hysterectomy hospitalizations submitted to PHC4 for inclusion in the *Managed Care Performance Report*, 24 records (0 HMO records, 24 statewide records) were identified as duplicates. As a result, 21,402 hysterectomy hospitalizations (statewide; prior to the removal of excluded records) were investigated in this report.

Data Analyzed

For the *Managed Care Performance Report,* only elective hysterectomy procedures are included in the study. Hysterectomies due to trauma or cancer (of the female reproductive system) are two of several clinical reasons for exclusion from these analyses (Table 8A). Additional exclusions to analyses follow.

Table 8A: Hysterectomy Hospitalizations Exclusions Involving Cancer or Trauma

	STATEWIDE Total Hospitalizations	
	N	*% of Total*
Total hysterectomy hospitalizations	21,402	100.0
Non-elective hysterectomy hospitalizations:		
❖ Cancers of the female reproductive system[1]	2,389	11.2
❖ Trauma to the female reproductive system[2]	3	<0.1
Total non-elective hospitalizations	2,392	11.2
Total hospitalizations meeting the inclusion criteria	19,010	88.8

[1] ICD.9.CM 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, 239.5

[2] ICD.9.CM 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, 947.4

For hysterectomy outcome analyses, **the main data component consists of a single acute care hospitalization (i.e., an index hospitalization) in which the principal procedure of hysterectomy is performed.** From a clinical standpoint, hysterectomy procedures are expected to involve only single hospitalizations. That is, hysterectomy episodes should include a single hospital admission and should not involve multiple hospitalizations/transfers. Therefore, for this report, hysterectomy episodes consisting of two or more hysterectomy hospitalizations (for a single patient) are considered erroneous hospitalizations and are excluded from the analyses at the outset (see "problematic records" in Table 8B below).

Table 8B: Records Excluded Prior to Any Hysterectomy Analyses

	HMO		STATEWIDE	
	Total Hospitalizations		Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations *before* exclusions	6,117	100.0	19,010	100.0
Exclusions:				
❖ Problematic records [†]	0	0.0	6	<0.1
Total hospitalizations remaining in analysis	6,117	100.0	19,004	99.9

[†] For example, case in which a patient is recorded as having more than one hysterectomy hospitalization

Outcome Measures and Exclusion Criteria

Hospitalization Rate (age-adjusted; per 10,000 female members). This measure is reported for adult cases only. *Hospitalization rate* for hysterectomy is sub-categorized by the type of surgical approach (vaginal vs. abdominal) employed. Hospitalizations that involve both vaginal and abdominal procedures are classified as abdominal hospitalizations. The *hospitalization rate* is calculated for each HMO using the total number of single hospitalizations for hysterectomy. Consequently, **a single hospitalization in which a hysterectomy is performed is used to determine *hospitalization rate*.** The *hospitalization rate* for a particular HMO plan incorporates the total number of single hysterectomy hospitalizations in the numerator and the total number of female enrollees for the plan in the denominator. HMO benchmark rates are calculated using data from all HMO hospitalizations under the age of 65 combined; the HMO benchmark serves as a comparison for each of the HMO plans. Hospitalizations that are excluded from the *hospitalization rate* analysis for hysterectomy are listed in Table 8C.

Table 8C: Exclusions from "Hospitalization Rate" Analysis for Hysterectomy

	HMO Total Hospitalizations		STATEWIDE Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations *before* exclusions	6,117	100.0	19,004	100.0
Exclusions:				
❖ Age < 18 yr	0	0.0	1	<0.1
❖ Hospitalizations that were clinically complex:				
Any cancer (other than history of cancer)[1]	23	0.4	87	0.5
Hemorrhage on admission[2]	0	0.0	4	<0.1
Pregnancy-related complications leading to hysterectomy[3]	3	<0.1	24	0.1
Total Exclusions	26	0.4	116	0.6
Total hospitalizations remaining in analysis	6,091	99.6	18,888	99.4

[1] Subsequent to data verification, these hospitalizations were deemed necessary exclusions due to cancer status of all other body sites.
[2] Hemorrhage (as principal diagnosis) complicating a procedure; ICD.9.CM code 998.11
[3] Pregnancy, childbirth or puerperium complications; MDC 14

In-Hospital Complication Rate (risk-adjusted). This measure is reported separately for abdominal and vaginal *adult* hysterectomies only and is calculated for each managed care organization. ***In-hospital complications*** **are any one of a particular set of ICD.9.CM codes in any secondary diagnosis or procedure in a discharge record associated with the hysterectomy hospitalization.** Calculation of the actual *complication rate* for an individual HMO plan incorporates the total number of complications for a hysterectomy procedure by the plan in the numerator and the total number of single hospitalizations for a hysterectomy for the plan in the denominator. In the *Managed Care Performance Report,* the *in-hospital complication rate* is reported as a percentage. Refer to Appendix D: Definition of In-Hospital Complications for Hysterectomy for a detailed description of the complications associated with abdominal and vaginal (reported separately) hysterectomy procedures. The exclusions to the *complication rate* analysis for hysterectomy are outlined in Table 8D.

Table 8D: Exclusions from "Complication Rate" Analysis for Hysterectomy

	HMO Total Hospitalizations		STATEWIDE Total Hospitalizations	
	N	*% of Total*	*N*	*% of Total*
Total hospitalizations *before* exclusions	6,117	100.0	19,004	100.0
Exclusions:				
❖ Hospitalization rate exclusions	26	0.4	116	0.6
❖ Hospitalizations with a missing *Atlas* PLOS	188	3.1	617	3.2
Total Exclusions	214	3.5	733	3.9
Total hospitalization remaining in analysis	5,903	96.5	18,271	96.1

Length of Stay (risk-adjusted). **The inpatient *length of stay* (risk-adjusted) for hysterectomy is the period of hospitalization beginning with the date of admission of the hospitalization in which the hysterectomy procedure is performed and ending with the date of discharge of the same hospitalization.** The exclusions to the *length of stay* analysis for hysterectomy are outlined in Table 8E.

Table 8E: Exclusions from "Length of Stay" Analysis for Hysterectomy

	HMO			STATEWIDE		
	Total Hospitalizations		LOS	Total Hospitalizations		LOS
	N	*% of Total*	*Ave.*	*N*	*% of Total*	*Ave.*
Total hospitalizations *before* exclusions	6,117	100.0	2.8	19,004	100.0	2.8
Exclusions:						
❖ Complication rate exclusions	214	3.5	2.8	733	3.9	3.2
❖ Death in hospital	0	0.0	-	3	<0.1	19.3
❖ Outlier[1]/invalid[2] or missing LOS	29	0.5	13.5	92	0.5	14.9
Total Exclusions	243	4.0	4.1	828	4.4	4.5
Total hospitalizations remaining in analysis	5,874	96.0	2.7	18,176	95.6	2.7

[1] LOS greater than the 99.5th percentile: LOS > 11 days in abdominal hysterectomy hospitalizations or LOS > 5 days in vaginal hysterectomy hospitalizations

[2] LOS value < 0

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APPENDIX A: DESCRIPTION OF STUDY POPULATION BY ICD.9.CM CODE

Asthma

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

ICD.9.CM Diagnosis Code	Description
493.00	Extrinsic asthma without mention of status asthmaticus
493.01	Extrinsic asthma with status asthmaticus
493.10	Intrinsic asthma without mention of status asthmaticus
493.11	Intrinsic asthma with status asthmaticus
493.20	Chronic obstructive asthma without mention of status asthmaticus
493.21	Chronic obstructive asthma with status asthmaticus
493.90	Asthma, unspecified without mention of status asthmaticus
493.91	Asthma, unspecified with status asthmaticus

Heart Attack

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

ICD.9.CM Diagnosis Code	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

Heart Failure

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

ICD.9.CM Diagnosis Code	Description
398.91	Rheumatic heart failure (congestive)
402.01	Malignant hypertensive heart disease with congestive heart failure
402.11	Benign hypertensive heart disease with congestive heart failure
402.91	Unspecified hypertensive heart disease with congestive heart failure
404.01	Malignant hypertensive heart & renal disease with congestive heart failure
404.03	Malignant hypertensive heart & renal disease with congestive heart failure and renal failure
404.11	Benign hypertensive heart and renal disease with congestive heart failure
404.13	Benign hypertensive heart and renal disease with congestive heart failure and renal failure
404.91	Unspecified hypertensive heart and renal disease with congestive heart failure
404.93	Unspecified hypertensive heart and renal disease with congestive heart failure and renal failure
428.0	Congestive heart failure
428.1	Left heart failure
428.9	Heart failure, unspecified

Hysterectomy (non-malignant and non-emergent)

- The procedure codes listed below were included in the analyses only when listed as the principal procedure, or as the first secondary procedure when the principal diagnosis was a "minor" female reproductive procedure. However, a portion of these procedures were excluded from the analyses when a diagnosis code for female reproductive malignancy or pelvic/lower abdominal trauma appeared in any diagnosis position. Procedures that were emergent were also removed.

- Removal of hysterectomy procedures with a related malignant, emergent, or traumatic diagnosis focuses upon those procedures that are elective. Hence, hysterectomy procedures analyzed for this report differ from the other three clinical outcomes/treatments. The hospitalizations included for analysis are for elective surgeries only.

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

APPENDIX B: METHODS FOR RESOLVING INCONSISTENT PATIENT IDENTIFIER INFORMATION

In analyzing a series of hospitalizations identified for an adult patient, conflicting sex-birth date combinations (for a single SSN) with the **same** sex value were resolvable if:

1. there were only **two** different birth dates (DOB) that agreed on two of the three DOB components (day, month, year) **and**

2. one of the conflicting DOBs appeared in the database at least two more times than the other (i.e., there were at least two additional occurrences of the more frequent DOB compared to the less frequent DOB) **or** the conflicting DOBs were within 31 days of each other.

The birth date which occurred with greatest frequency (or the more recent birth date if the frequency was the same for both dates) was assigned to all hospitalizations for that SSN.

Multiple sex-birth date combinations (for a single SSN) with the **same** birth date were resolvable if one of the conflicting sex values appeared in the database at least two more times than the other sex value. Thus, the sex value that occurred with the greatest frequency was assigned to all hospitalizations for that SSN as long as there were at least two additional occurrences of the more frequent sex value compared to the other sex value.

APPENDIX C. *ATLAS* ADMISSION SEVERITY

- ASTHMA -

Table C.1a. *Atlas* Disease Groups for Adult Asthma

Adult asthma hospitalizations in the *Managed Care Performance Report* were scored according to the following *Atlas* disease groups:

Atlas Disease Group†	*Atlas* Disease Group Code	%
Asthma	(400)	82.2
Chronic lung disorder	(410)	17.6
Miscellaneous		0.1
Total		100.0

† Disease groups are based on the principal diagnosis.

Table C.1b. *Atlas* Disease Groups for Pediatric Asthma

Pediatric asthma hospitalizations in the *Managed Care Performance Report* were scored according to the following *Atlas* disease groups:

Atlas Disease Group†	*Atlas* Disease Group Code	%
Asthma	(400)	99.8
Chronic lung disorder	(410)	0.1
Miscellaneous		0.1
Total		100.0

† Disease groups are based on the principal diagnosis.

Background *Atlas* information is shown below (Tables C.1c – C.1e) for the most predominant asthma disease group code (i.e., 400).

Table C.1c. Asthma *Atlas* Definition: Disease Group 400

Diagnosis Code	Description
493.00	Extrinsic asthma without status asthmaticus
493.01	Extrinsic asthma with status asthmaticus
493.10	Intrinsic asthma without status asthmaticus
493.11	Intrinsic asthma with status asthmaticus
493.90	Asthma, unspecified without status asthmaticus
493.91	Asthma, unspecified with status asthmaticus

Table C.1d. *Atlas* Variables Used to Compute Clinical LOS: Asthma

Variables & KCFs	Variables & KCFs
Age in Months	**Damage Group**
Age in Years	AST > 80 U/L
Central Region Group[1]	CPK > 150 U/L
Hospitals in Regions 4, 5, 6 or 7	Damage
Congenital Combination	Tear
Aortic Arch Abnormality	**Diabetes**
Cerebral Palsy	**Hematocrit % Low**
Congenital Anomaly	**Immunocompromised Group**
Congenital Heart Disease	Current Medication Immunosuppressive
Cystic Fibrosis	HIV Positive
Hypoplastic Heart	Immunocompromised
Major Cardiac Anomaly	Transplant Rejection
Mental Retardation	**Lesion**
Open Defect	**Mechanical Ventilator Any Days**
Transposition	**Non-Sinus Rhythm Group**
Trisomy	Atrial Fibrillation
Constant/Intercept	Atrial Flutter
Culture Combination	AV Conduction Disturbance
Blood or Lymph Culture	Multifocal Atrial Tachycardia
GI Culture	Pacemaker Malfunction
Reproductive Culture	Pulse < 65
Respiratory Culture	Sino Atrial Dysfunction
Skin Culture	Ventricular Tachycardia
Spinal Cord Culture	**$p0_2$ Arterial**
Urinary Culture	**Pulse High**
	West Region Group[2]
	Hospitals in Regions 8 or 9

[1] Refer to Table C.1e., superscript 1 for description
[2] Refer to Table C.1e., superscript 7 for description.
Source: CIC/MediQual Systems, Inc. Specific information on KCFs is included in the *Atlas Glossary*

Table C.1e. Mortality and LOS *Atlas* Coefficients for Asthma

Asthma Variable	Variable code #	Clinical Mortality		Clinical LOS	
		Significant in Model	Coefficient	Significant in Model	Coefficient
Age in Months	(707)			✓	-0.05045000
Age in Years	(277)			✓	0.03446900
Age Squared	(701)	✓	0.00058610		
Central Region Group[1]	(2613)			✓	-0.31479400
Constant/Intercept	(0)	✓	-1.00780000	✓	6.35831600
Congenital Combination[2]	(620)			✓	0.82064800
Culture Combination[3]	(630)			✓	0.37167000
Damage Group[4]	(672)			✓	0.33565800
Diabetes	(805)			✓	0.52854400
Glucose mg/dL High	(3172)	✓	0.00560000		
Hematocrit % Low	(3561)			✓	-0.03336200
History of CHF	(832)	✓	1.22130000		
Immunocompromised Group[5]	(680)			✓	0.23075800
Lesion	(1001)			✓	0.35712900
Mechanical Ventilator Any Days	(5998)			✓	1.18570500
Non Sinus Rhythm Group[6]	(651)			✓	0.49119000
O_2 Saturation Arterial %	(3323)	✓	-0.06480000		
pO_2 Arterial	(3314)			✓	-0.02347000
Pulse High	(5012)			✓	0.00387500
West Region Group[7]	(2614)			✓	-0.21733500
White Blood Cell (WBC) Count Low	(3661)	✓	-0.33980000		

[1] This group variable is based on hospital numbers starting with 4 (designated as Region 4 by CIC/MediQual Systems, Inc.; code 740), 5 (Region 5; code 741), 6 (Region 6; code 742), or 7 (Region 7; code 743). The states included in the Central Region Group include: IL, OH, MI, IN, WI, TN, KY, AL, MS, MN, ND, NE, IA, MO, SD, KS, LA, OK, AR, and TX.

[2] Aortic arch abnormality (1202), cerebral palsy (821), congenital anomaly (836), congenital heart disease (829), cystic fibrosis (806), hypoplastic heart (1232), major cardiac anomaly (1231), mental retardation (825), open defect (1200), transposition (1233), trisomy (834)

[3] Blood or lymph culture (4005), GI culture (4023), reproductive culture (4031), respiratory culture (4033), skin culture (4035), spinal cord culture (4037), urinary culture (4039)

[4] Heart damage group: AST > 80 U/L (760), CPK > 150 U/L (759), damage (1361), tear (1390)

[5] Current medication immunosuppressive (892), HIV positive (807), immunocompromised (819), transplant rejection (1554)

[6] Atrial fibrillation (5518), atrial flutter (5520), AV conduction disturbance (5512), multifocal atrial tachycardia (5526), pacemaker malfunction (1552), pulse < 65 (782), sino atrial dysfunction (5514), ventricular tachycardia (5516)

[7] This group variable is based on hospital numbers starting with 8 (designated as Region 8 by CIC/MediQual Systems, Inc.; code 729) or 9 (designated as Region 9 by CIC/MediQual Systems, Inc.; code 730). The states included in the West Region Group include: CO, AZ, CA, OR, WA, NV, MT, WY, NM, ID, HI, and AK.

- ACUTE MYOCARDIAL INFARCTION -

Table C.2a. *Atlas* Disease Groups for AMI

AMI hospitalizations in the *Managed Care Performance Report* were scored according to the following *Atlas* disease groups:

Atlas Disease Group†	*Atlas* Disease Group Code	%
Myocardial infarction	(550)	99.8
Angina	(555)	0.1
Miscellaneous		0.1
Total		100.0

† Disease groups are based on the principal diagnosis.

Background *Atlas* information is shown below (Tables C.2b – C.2d) for the most predominant AMI disease group code (i.e., 550).

Table C.2b. Myocardial Infarction *Atlas* Definition: Disease Group 550

Diagnosis Code†	**Description**
410.X1	**Fifth digit "1" indicates the AMI was an *initial* episode of care**
410.01	AMI of anterolateral wall
410.11	AMI of other anterior wall
410.21	AMI of inferolateral wall
410.31	AMI of inferoposterior wall
410.41	AMI of other inferior wall
410.51	AMI of other lateral wall
410.61	True posterior wall infarction
410.71	Subendocardial infarction
410.81	AMI of other specified sites
410.91	AMI of unspecified site
410.X2	**Fifth digit "2" indicates the AMI was a *subsequent* episode of care**
410.X0	**Fifth digit "0" indicates the AMI was an *unspecified* episode of care**

† **X** indicates the infarct location

Table C.2c. *Atlas* Variables Used to Compute Clinical Mortality ASG: Myocardial Infarction

Variables & KCFs	Variables & KCFs
Acute Neurology Combination	**Coma Group**
Acute Aphasia	Coma or Stupor
Acute Apraxia	Coma Score < 8
Acute Ataxia	**Constant/Intercept**
Acute Cranial Nerve Deficit	**Creatine Phosphokinase (CPK) U/L**
Acute Flaccid	**Damage Group**
Acute Muscle Weakness	AST > 80 U/L
Acute Paresis	CPK > 150 U/L
Acute Sensory Deficit	Damage
Acute Speech Deficit	Tear
Acute Tremors	**Diastolic BP**
Gait Abnormality	**Fluid Imbalance Combination**
Proprioception	K < 2.5 or > 5.3
Age in Years	Na < 130 or > 150
Albumin g/dL	**Glucose mg/dL High**
	Left Main Disease
Blood Urea Nitrogen (BUN) mg/dL	**Myocardial Infarction**
Coronary Artery Disease (CAD) Group	**pCO_2 Arterial**
Circumflex > 49%	**pH Arterial Low**
Ischemia	**pO_2 Arterial**
LAD > 49%	**Previous CABG**
Left Main > 49%	**Renal Group**
RCA > 49%	BUN > 30 mg/dL
Stress Test Positive	Chronic Renal Disease
Congestive Heart Failure (CHF) Group	Creatinine > 1.7 mg/dL
CHF	Urine Protein mg/24 hr
Edema	**Respirations High**
Effusion Respiratory	**Resuscitation**
Ejection Fraction < 41%	**Seizure Group**
History of CHF	Previous Seizures
S3 Gallop	Seizure
Wedge Pressure > 14	**Systolic BP Low**
Coagulation Defect Group	**WBC High**
Platelets < 100 10^9/L	
PT > 15.5 sec	
PTT > 35.9	

Source: CIC/MediQual Systems, Inc. Specific information on KCFs is included in the *Atlas Glossary*

Table C.2d. Mortality and LOS *Atlas* Coefficients for Myocardial Infarction

Myocardial Infarction Variable	Variable code #	Clinical Mortality Significant in Model	Clinical Mortality Coefficient	Clinical LOS Significant in Model	Clinical LOS Coefficient
Acute Neurology Combination[1]	(600)	✓	0.57560000	✓	0.66005100
Admission Period Surgery	(710)			✓	-0.57963800
Age in Years	(277)	✓	0.06590000	✓	0.03851600
Albumin g/dL	(3030)	✓	-0.24910000		
Aspartate Aminotransferase (AST) U/L	(3039)			✓	0.00121600
Blood Urea Nitrogen (BUN) mg/dL	(3260)	✓	0.00740000	✓	0.00772500
Central Region Group[2]	(2613)			✓	-0.47840400
Congestive Heart Failure (CHF)	(1500)			✓	-0.39350000
Congestive Heart Failure (CHF) Group[3]	(664)	✓	0.45580000	✓	0.53932400
Coagulation Defect Group[4]	(666)	✓	-0.37970000		
Coma Group[5]	(654)	✓	1.12650000		
Coma Score 3 – 15	(5043)			✓	-0.12131100
Constant/Intercept	(0)	✓	22.76690000	✓	-34.28646700
COPD Group[6]	(670)			✓	0.27014000
Coronary Artery Disease (CAD) Group[7]	(658)	✓	-0.17060000	✓	-1.00866300
Creatine Phosphokinase (CPK) U/L	(3060)	✓	0.00015430	✓	0.00037897
Creatine Phosphokinase – Heart (CPK-MB) %	(3070)			✓	0.01756800
Culture Combination[8]	(630)			✓	0.34966900
Damage Group[9]	(672)	✓	-0.57490000		
Diabetes	(805)			✓	0.35259600
Diastolic BP	(5024)	✓	-0.01360000		
Effusion	(1321)			✓	0.64247900
Enlarged Heart	(1700)			✓	0.19414500
Fluid Imbalance Combination[10]	(635)	✓	0.36450000	✓	0.52206700
Gender	(278)			✓	-0.25020200
Glucose mg/dL High	(3172)	✓	0.00087490		
Hemoglobin g/dL Low	(3571)			✓	-0.25896700
History CAD Group[11]	(660)			✓	0.39719100
Inflammation Group[12]	(678)			✓	0.50779900
Ischemia	(1502)			✓	0.76654000
Left anterior descending artery (LAD)	(1305)			✓	0.01034900
Left Main Artery Disease	(1308)	✓	0.01020000	✓	0.01336400
Lesion	(1001)			✓	0.36327500
Mechanical Ventilator Any Days	(5998)			✓	1.87276600
Myocardial Infarction	(1501)	✓	0.30380000		
Myocardial Infarction (MI) Group[13]	(690)			✓	0.30556900
Oral Temperature ^{o}F Low	(5001)			✓	0.13180900
pCO_2 Arterial	(3317)	✓	-0.02710000		
pH Arterial High	(3302)			✓	4.38195700
pH Arterial Low	(3301)	✓	-3.25770000		
pO_2 Arterial	(3314)	✓	-0.02220000		
Partial Thromboplastin Time (PTT) sec	(3450)			✓	0.00761900
Previous CABG	(831)	✓	0.38110000		
Previous Seizures	(820)			✓	0.64951300

Table C.2d. Mortality and LOS *Atlas* Coefficients for Myocardial Infarction continued

Myocardial Infarction Variable	Variable code #	Clinical Mortality: Significant in Model	Clinical Mortality: Coefficient	Clinical LOS: Significant in Model	Clinical LOS: Coefficient
Previous Stroke	(811)			✓	0.33087100
Pulse Low	(5011)			✓	-0.02534500
Renal Group[14]	(692)	✓	0.43120000		
Respirations High	(5032)	✓	0.02820000		
Resuscitation	(9000)	✓	2.32320000		
Right Coronary Artery (RCA)	(1310)			✓	0.00512700
S3 Gallop	(5524)			✓	0.45945000
Seizure Group[15]	(694)	✓	0.43040000		
Syncope	(822)			✓	0.62042800
Systolic BP Low	(5021)	✓	-0.02400000	✓	-0.00960400
West Region Group[16]	(2614)			✓	-1.32800700
White Blood Cell (WBC) Count High	(3662)	✓	0.01380000		

[1] This combination is composed of acute aphasia (2115), acute apraxia (2119), acute ataxia (2106), acute cranial nerve deficit (2102), acute flaccid (2119), acute muscle weakness (2113), acute paresis (2100), acute sensory deficit (2110), acute speech deficit (2117), acute tremors (2104), gait abnormality (2050), and proprioception (2065).

[2] This group variable is based on hospital numbers starting with 4 (designated as Region 4 by CIC/MediQual Systems, Inc.; code 740), 5 (Region 5; code 741), 6 (Region 6; code 742), or 7 (Region 7; code 743). The states included in the Central Region Group include: IL, OH, MI, IN, WI, TN, KY, AL, MS, MN, ND, NE, IA, MO, SD, KS, LA, OK, AR, and TX.

[3] This group variable is composed of CHF (1500), edema (1399), effusion respiratory (776), ejection fraction < 41% (785), History of CHF (832), S3 gallop (5524), wedge pressure > 14 (784)

[4] This variable is composed of platelets < 100 10^9 /L (758), prothrombin time > 15.5 sec (756), or partial thromboplastin time > 35.9 (757).

[5] This variable is made up of coma or stupor (2010) or coma score < 8 (780)

[6] Chronic Obstructive Pulmonary Disease: Chronic lung disease (840) or FEV1 (forced expiratory volume per second) < 66% predicted (773)

[7] Circumflex > 49% (720), ischemia (1502), LAD (left anterior descending artery) > 49% (721), left main artery > 49% (722), RCA (right coronary artery) > 49% (723), or stress test positive (5530)

[8] Blood or lymph culture (4005), GI culture (4023), reproductive culture (4031), respiratory culture (4033), skin culture (4035), spinal cord culture (4037), urinary culture (4039)

[9] Heart damage group: AST > 80 U/L (760), CPK > 150 U/L (759), damage (1361), tear (1390)

[10] K < 2.5 or > 5.3 (751), Na < 130 or > 150 (752)

[11] Current medication anticoagulant (890), failed PTCA (1550), history of angina (816), previous CABG (831), previous PTCA (837)

[12] Active herpes (262), bands > 20% (765), CSF WBC > 0 c/mm^3 (727), degeneration (1370), history of autoimmune disease (803), infection (1407), inflammation (1400), oral temperature < 95.5 ^oF or > 100.9 ^oF (786), or WBC < 5 or > 17.0 (766)

[13] CPK MB > 3% (770) or MI (1501)

[14] BUN > 30 mg/dL (771), chronic renal disease (833), creatinine > 1.7 mg/dL (772), or urine protein mg/24 hr (3800)

[15] Previous seizures (820) or seizure (2060)

[16] This group variable is based on hospital numbers starting with 8 (designated as Region 8 by CIC/MediQual Systems, Inc.; code 729) or 9 (designated as Region 9 by CIC/MediQual Systems, Inc.; code 730). The states included in the West Region Group include: CO, AZ, CA, OR, WA, NV, MT, WY, NM, ID, HI, and AK.

- HEART FAILURE -

Table C.3a. *Atlas* Disease Groups for Heart Failure

Heart failure hospitalizations in the *Managed Care Performance Report* were scored according to the following *Atlas* disease groups:

Atlas Disease Group[†]	*Atlas* Disease Group Code	%
Heart failure	(560)	95.0
Hypertensive heart disorder	(530)	3.0
Acquired cardiac valve disorder	(520)	1.7
Miscellaneous		0.3
Total		100.0

[†] Disease groups are based on the principal diagnosis.

Background *Atlas* information is shown below (Tables C.3b – C.3d) for the most predominant heart failure disease group code (i.e., 560).

Table C.3b. Heart Failure *Atlas* Definition: Disease Group 560

Diagnosis Code	Description
402.01	Malignant Hypertensive Heart Disease w CHF
402.11	Benign Hypertensive Heart Disease w CHF
402.91	Unspecified Hypertensive Heart Disease w CHF
404.01	Malignant Hypertensive Heart and Renal Disease w CHF
404.11	Benign Hypertensive Heart and Renal Disease w CHF
404.91	Unspecified Hypertensive Heart and Renal Disease w CHF
415.0	Acute Pulmonary Heart Disease - Acute Coronary Pulmonale
416.0	Chronic Pulmonary Heart Disease - Primary Pulmonary Hypertension
416.1	Chronic Pulmonary Heart Disease - Kyphoscoliotic Heart Disease
416.8	Chronic Pulmonary Heart Disease - other
416.9	Chronic Pulmonary Heart Disease - unspecified
417.0	Other Diseases of Pulmonary Circulation - Arteriovenous Fistula of Pulmonary Vessels
417.1	Other Diseases of Pulmonary Circulation - Pulmonary Artery Aneurysm
417.8	Other Diseases of Pulmonary Circulation – Other Specified Diseases of Pulmonary Circulation
417.9	Disease of Pulmonary Circulation - unspecified
428.0	Congestive Heart Failure
428.1	Left Heart Failure
428.9	Heart Failure - unspecified
785.50	Shock - unspecified
785.51	Cardiogenic Shock

Table C.3c. *Atlas* Variables Used to Compute Clinical Mortality ASG: Heart Failure

Variables & KCFs	Variables & KCFs
Age in Years	**Inflammation Group**
Aspartate Aminotransferase (AST) U/L	Active Herpes
BUN mg/dL	Bands > 20%
CHF Group	CSF WBC > 0 c/mm^3
CHF	Degeneration
Edema	History of Autoimmune Disease
Effusion Respiratory	Infection
Ejection Fraction < 41%	Inflammation
History of CHF	Oral Temp < 95.5 ^oF or > 100.9 ^oF
S3 Gallop	WBC < 5 or > 17.0
Wedge Pressure > 14	**Lethargy**
Chronic Anemia	**Liver Group**
Chronic Paresis	Alkaline Phosphatase > 200 U/L
Coagulation Defect Group	Chronic Liver Disease
Platelets < 100 10^9/L	Effusion Abdomen
PT > 15.5 sec	Total Bilirubin > 9.0 mg/dL
PTT > 35.9	**Malnutrition Group**
Constant/Intercept	Albumin < 3.0 g/dL
Creatine Phosphokinase (CPK) U/ L	Severe Malnutrition
Creatinine mg/dL	**Mechanical Vent Days**
Current Medication Anticoagulant	**O_2 Saturation Arterial %**
Current Medication Immunosuppressive	**pH Arterial High**
Diastolic BP	**pH Arterial Low**
Edema	**Prothrombin Time (PT) sec**
Fluid Imbalance Combination	**Regurgitation**
K < 2.5 or > 5.3	**Renal Group**
Na < 130 or > 150	BUN > 30 mg/dL
Gender	Chronic Renal Disease
Female has higher risk	Creatinine > 1.7 mg/dL
History of Cancer	Urine Protein mg/24 hr
	Respirations High
	Seizure Group
	Previous Seizures
	Seizure
	Systolic BP Low

Source: CIC/MediQual Systems, Inc. Specific information on KCFs is included in the *Atlas Glossary*

Table C.3d. Mortality and LOS *Atlas* Coefficients for Heart Failure

Heart Failure Variable	Variable code #	Clinical Mortality: Significant in Model	Clinical Mortality: Coefficient	Clinical LOS: Significant in Model	Clinical LOS: Coefficient
Admission Period Surgery	(710)			✓	0.99274400
Age in Years	(277)	✓	0.03360000	✓	0.01972700
Alkaline Phosphatase U/L	(3206)			✓	-0.00117500
Anemia Group[1]	(650)			✓	0.28488700
Aspartate Aminotransferase (AST) U/L	(3039)	✓	0.00050000	✓	0.00140200
Blood Urea Nitrogen (BUN) mg/dL	(3260)	✓	0.01640000	✓	0.02435600
Central Region Group[2]	(2613)			✓	-0.27902400
Chronic Anemia	(804)	✓	-0.35920000		
Chronic Neurology Combination[3]	(601)			✓	0.18885300
Chronic Paresis	(2101)	✓	0.62640000		
Coagulation Defect Group[4]	(666)	✓	0.20190000	✓	0.31173900
Congestive Heart Failure (CHF)	(1500)			✓	-0.18895700
Congestive Heart Failure (CHF) Group[5]	(664)	✓	-0.63510000		
Constant/Intercept	(0)	✓	2.42720000	✓	-56.32004700
COPD Group[6]	(670)			✓	0.35910500
Creatine Phosphokinase (CPK) U/L	(3060)	✓	0.00030000	✓	0.00070577
Creatinine mg/dL	(3080)	✓	-0.09520000	✓	-0.21198500
Culture Combination[7]	(630)			✓	0.74920100
Current Medication Anticoagulant	(890)	✓	-0.26420000		
Current Medication Immunosuppressive	(892)	✓	0.35280000		
Current Medication Insulin	(894)			✓	0.24395300
Diastolic BP	(5024)	✓	-0.01610000	✓	-0.00815700
Edema	(1399)	✓	0.26980000	✓	0.96368400
Effusion	(1321)			✓	0.51871800
Fluid Imbalance Combination[8]	(635)	✓	0.57510000	✓	0.38185800
Gender (female has higher risk)	(278)	✓	0.15160000	✓	-0.39127400
Hematocrit % Low	(3561)			✓	-0.02360700
History of Cancer	(810)	✓	0.26100000		
Inflammation	(1400)			✓	1.14247800
Inflammation Group[9]	(678)	✓	0.41300000	✓	0.19404600
Lethargy	(2020)	✓	0.74990000	✓	0.75994600
Liver Group[10]	(684)	✓	0.25640000	✓	0.43744300
Malnutrition Group[11]	(686)	✓	0.60720000	✓	0.91886900
Mechanical Ventilator Any Days	(5998)			✓	1.46534600
Mechanical Ventilator Days	(9010)	✓	0.08010000		
Myocardial Infarction (MI) Group[12]	(690)			✓	0.15161800
Non-Sinus Rhythm Group[13]	(651)			✓	0.30563700
O_2 Saturation Arterial %	(3323)	✓	-0.02930000		
Oral Temperature ^{o}F High	(5002)			✓	0.30163100
pCO_2 Arterial	(3317)			✓	0.02197000
pH Arterial High	(3302)	✓	1.89580000	✓	4.10275300
pH Arterial Low	(3301)	✓	-2.15930000		
pO_2 Arterial	(3314)			✓	-0.01316000
Partial Thromboplastin Time (PTT) sec	(3450)			✓	0.01555600
Prothrombin Time (PT) sec	(3460)	✓	0.01530000		

Table C.3d. Mortality and LOS *Atlas* Coefficients for Heart Failure continued

Heart Failure Variable	Variable code #	Clinical Mortality: Significant in Model	Clinical Mortality: Coefficient	Clinical LOS: Significant in Model	Clinical LOS: Coefficient
Pulse High	(5012)			✓	0.00573400
Regurgitation	(5506)	✓	-0.30160000	✓	0.26099400
Renal Group[14]	(692)	✓	0.35370000		
Respirations High	(5032)	✓	0.02040000	✓	0.02059100
S3 Gallop	(5524)			✓	0.24200600
Seizure Group[15]	(694)	✓	0.69580000		
Severe Malnutrition				✓	-0.70413700
Stenosis	(1373)			✓	0.36002900
Systolic BP Low	(5021)	✓	-0.03110000		
Total Bilirubin mg/dL	(3048)			✓	0.12814800
West Region Group[16]	(2614)			✓	-0.91642800

[1] This group variable is composed of chronic anemia (804), hematocrit < 40% (753) and hemoglobin < 13.4 g/dL (754).

[2] This group variable is based on hospital numbers starting with 4 (designated as Region 4 by CIC/MediQual Systems, Inc.; code 740), 5 (Region 5; code 741), 6 (Region 6; code 742), or 7 (Region 7; code 743). The states included in the Central Region Group include: IL, OH, MI, IN, WI, TN, KY, AL, MS, MN, ND, NE, IA, MO, SD, KS, LA, OK, AR, and TX.

[3] Chronic aphasia (2116), chronic apraxia (2120), chronic ataxia (2107), chronic cranial nerve deficit (2103), chronic flaccid (2109), chronic muscle weakness (2114), chronic paresis (2101), chronic sensory deficit (2112), chronic speech deficit (2118), chronic tremors (2105), previous head trauma (824), previous stroke (811)

[4] This variable is composed of platelets < 100 10^9 /L (758), prothrombin time > 15.5 sec (756), or partial thromboplastin time > 35.9 (757).

[5] This group variable is composed of CHF (1500), edema (1399), effusion respiratory (776), ejection fraction < 41% (785), History of CHF (832), S3 gallop (5524), wedge pressure > 14 (784).

[6] Chronic Obstructive Pulmonary Disease: Chronic lung disease (840) or FEV1 (forced expiratory volume per second) < 66% predicted (773)

[7] Blood or lymph culture (4005), GI culture (4023), reproductive culture (4031), respiratory culture (4033), skin culture (4035), spinal cord culture (4037), urinary culture (4039)

[8] K < 2.5 or > 5.3 (751), Na < 130 or > 150 (752)

[9] Active herpes (262), bands > 20% (765), CSF WBC > 0 c/mm^3 (727), degeneration (1370), history of autoimmune disease (803), infection (1407), inflammation (1400), oral temperature < 95.5 ^oF or > 100.9 ^oF (786), or WBC < 5 or > 17.0 (766)

[10] Alkaline phosphatase > 200 U/L (767), chronic liver disease (809), effusion abdomen (777), total bilirubin > 9.0 mg/dL (768)

[11] Albumin < 3.0 g/dL (769), severe malnutrition (1043)

[12] CPK MB > 3% (770) or MI (1501)

[13] Atrial fibrillation (5518), atrial flutter (5520), AV conduction disturbance (5512), multifocal atrial tachycardia (5526), pacemaker malfunction (1552), pulse < 65 (782), sino atrial dysfunction (5514), ventricular tachycardia (5516)

[14] BUN > 30 mg/dL (771), chronic renal disease (833), creatinine > 1.7 mg/dL (772), or urine protein mg/24 hr (3800)

[15] Previous seizures (820) or seizure (2060)

[16] This group variable is based on hospital numbers starting with 8 (designated as Region 8 by CIC/MediQual Systems, Inc.; code 729) or 9 (designated as Region 9 by CIC/MediQual Systems, Inc.; code 730). The states included in the West Region Group include: CO, AZ, CA, OR, WA, NV, MT, WY, NM, ID, HI, and AK.

- HYSTERECTOMY -

Table C.4a. *Atlas* Disease Groups for Hysterectomy

Hysterectomy hospitalizations in the *Managed Care Performance Report* were scored according to the following *Atlas* disease groups:

Atlas Disease Group†	*Atlas* Disease Group Code	%
Female Reproductive	(1300)	99.6
Miscellaneous		0.4
Total		100.0

† Disease groups are based on the principal diagnosis.

Background *Atlas* information is shown below (Tables C.4b – C.4d) for the most predominant disease group code (i.e., 1300: Female Reproductive).

Table C.4b. Female Reproductive *Atlas* Definition: Disease Group 1300†

Diagnosis Code Groups	Description
• 016.60 – 016.76, 054.10 – 054.12, 054.19, 091.0, 098.0, 098.10, 098.15 – 098.2, 098.35 – 098.39, 099.0 – 099.2, 099.40 – 099.50, 099.53, 099.55, 099.59, 099.8, 099.9, 112.1, 112.2, 131.00 – 131.02, 131.09	Infectious diseases of female genital organs
• 179 – 184.9, 195.3, 198.6, 198.82, 218.0 – 221.9, 233.1 – 233.3, 236.0 – 236.3	Neoplasms of female genital organs
• 614.0 – 616.9, 620.0 – 620.9, 622.0 – 624.9	Inflammatory/noninflammatory disorders of female genital organs
• 256.0 – 256.9, 306.51, 306.52, 456.5, 456.6, 617.0 – 617.4, 617.8, 617.9, 618.0 – 618.9, 619.0, 619.2 – 619.9, 621.0 – 621.9, 629.0 – 629.9, 795.0	Other disorders of female genital tract
• 625.0 – 625.9, 698.1	Symptomatology (pain, pruritis) associated with female genital tract
• 626.0 – 626.9, 627.0 – 627.9, 628.0 – 628.9	Disorders related to menstruation/ menopause/infertility
• 752.0 – 752.49, 752.7 – 752.9, 758.6, 758.81, 758.89	Congenital/chromosomal anomalies of genital organs
• 867.4 – 867.9, 878.4 – 878.9, 908.2, 922.4, 926.0, 939.1, 939.2, 947.4, 996.32	Injury to genital organs
• V25.2, V25.3, V26.0, V50.42, V55.7, V61.5	Encounter for care related to female genital organs

† The diagnosis code groups shown above were taken from the *Atlas* disease group 1300 (female reproductive).

Table C.4c. *Atlas* Variables Used to Compute Clinical LOS: Female Reproductive

Variables & KCFs	Variables & KCFs
Admission Period Surgery	**History CAD Group**
Age in Years	Current Medication Anticoagulant
Anemia Group	Failed PTCA
Chronic Anemia	History of Angina
Hematocrit < 40%	Previous CABG
Hemoglobin < 13.4 g/dL	Previous PTCA
Benign Tumor	**Immunocompromised Group**
Bleeding	Current Medication Immunosuppressive
Central Region Group[1]	HIV positive
Region 4 Hospitals	Immunocompromised
Region 5 Hospitals	Transplant Rejection
Region 6 Hospitals	**Infection**
Region 7 Hospitals	**Infection Group**[2]
Chronic Lung Disease	**Lesion**
Chronic Neurology Combination	**Liver Group**
Chronic Aphasia	Alkaline Phosphatase > 200 U/L
Chronic Apraxia	Chronic Liver Disease
Chronic Ataxia	Effusion Abdomen
Chronic Cranial Nerve Deficit	Total Bilirubin > 9.0 mg/dL
Chronic Flaccid	**Malignant Tumor**
Chronic Muscle Weakness	**Malnutrition Group**
Chronic Paresis	Albumin < 3.0 g/dL
Chronic Sensory Deficit	Severe Malnutrition
Chronic Speech Deficit	**Mass Effect Group**
Chronic Tremors	Mass
Previous Head Trauma	Papilledema
Previous Stroke	**Mechanical Ventilator Any Days**
Constant/Intercept	**Oral Temperature ^{o}F High**
Cyst	**Respirations High**
Damage Group	**Stenosis**
AST > 80 U/L	**Uterine Prolapse > Grade 1**
CPK > 150 U/L	**West Region Group**[3]
Damage	Region 8 Hospitals
Tear	Region 9 Hospitals
Diabetes Group	
Current Medication, Insulin	
Diabetes	
Glucose < 60 or > 249 mg/dL	

[1] Refer to Table C.1e., superscript 1 for description.
[2] Refer to Table C.4d., superscript 8 for detailed list.
[3] Refer to Table C.1e. superscript 7 for description.
Source: CIC/MediQual Systems, Inc. Specific information on KCFs is included in the *Atlas Glossary*

Table C.4d. Mortality and LOS *Atlas* Coefficients for Female Reproductive

Female Reproductive Variable	Variable code #	Clinical Mortality Significant in Model	Clinical Mortality Coefficient	Clinical LOS Significant in Model	Clinical LOS Coefficient
Admission Period Surgery	(710)			✓	-0.19853900
Age in Years	(277)	✓	0.04430000	✓	0.01806400
Anemia Group[1]	(650)	✓	-1.65090000	✓	0.18335500
Benign Tumor	(1800)			✓	0.22641800
Bleeding	(1351)			✓	-0.55009100
Central Region Group[2]	(2613)			✓	-0.07209600
Chronic Lung Disease	(840)			✓	0.31634400
Chronic Neurology Combination[3]	(601)	✓	0.76850000	✓	0.26794900
Constant/Intercept	(0)	✓	1.97250000	✓	-18.44354600
Cyst	(1340)			✓	0.07201700
Damage Group[4]	(672)			✓	0.22538000
Diabetes Group[5]	(673)			✓	0.30630400
Hematocrit % Low	(3561)	✓	-0.12680000		
History CAD Group[6]	(660)			✓	0.29182200
History of Cancer	(810)	✓	2.23140000		
Immunocompromised Group[7]	(680)			✓	0.31059600
Infection	(1407)			✓	0.85330100
Infection Group[8]	(682)			✓	0.39312600
Lesion	(1001)			✓	0.28724000
Liver Group[9]	(684)	✓	1.29090000	✓	0.22218600
Malignant Tumor	(1813)			✓	1.11820700
Malnutrition Group[10]	(686)	✓	1.99670000	✓	0.89550900
Mass Effect Group[11]	(688)			✓	0.30293800
Mechanical Ventilator Any Days	(5998)			✓	2.11358300
Oral Temperature ^{o}F High	(5002)			✓	0.20664000
Respirations High	(5032)	✓	0.10750000	✓	0.02368000
Stenosis	(1373)			✓	0.13557600
Systolic BP Low	(5021)	✓	-0.07130000		
Uterine Prolapse > Grade 1	(1777)			✓	0.19770800
West Region Group[12]	(2614)			✓	-0.34754000

[1] This group variable is composed of chronic anemia (804), hematocrit < 40% (753) and hemoglobin < 13.4 g/dL (754).

[2] This group variable is based on hospital numbers starting with 4 (designated as Region 4 by CIC/MediQual Systems, Inc.; code 740), 5 (Region 5; code 741), 6 (Region 6; code 742), or 7 (Region 7; code 743). The states included in the Central Region Group include: IL, OH, MI, IN, WI, TN, KY, AL, MS, MN, ND, NE, IA, MO, SD, KS, LA, OK, AR, and TX.

[3] Chronic aphasia (2116), chronic apraxia (2120), chronic ataxia (2107), chronic cranial nerve deficit (2103), chronic flaccid (2109), chronic muscle weakness (2114), chronic paresis (2101), chronic sensory deficit (2112), chronic speech deficit (2118), chronic tremors (2105), previous head trauma (824), previous stroke (811)

[4] Heart damage group: AST > 80 U/L (760), CPK > 150 U/L (759), damage (1361), tear (1390)

[5] Current medication insulin (894), diabetes (805), glucose < 60 or > 249 mg/dL (761)

[6] Current medication anticoagulant (890), failed PTCA (1550), history of angina (816), previous CABG (831), previous PTCA (837)

[7] Current med immunosuppressive (892), HIV positive (807), immunocompromised (819), transplant rejection (1554)

Table C.4d. Mortality and LOS *Atlas* Coefficients for Female Reproductive continued

[8] Acinetobacter (4751), Bacillus (4791), Bacteroides (4759), Bordetella (4765), Brucella (4767), Campylobacter (4761), Chlamydia (4703), Clostridium (4793), Corynebacterium (4757), E. coli (4804), Enterobacter (4801), Fungus (ex Candida) (4831), Haemophilus (4771), Klebsiella (4811), Legionella (4769), Listeria (4753), mixed organisms (4891), Neisseria (4763), other organism (ex Fungi) (4898), Proteus (4808), Providencia (4755), Pseudomonas (4773), Salmonella (4813), Serratia (4815), Shigella (4806), Staph. aureus (4777), Staph. epidermidis (4779), Streptobacillus (4775), Streptococcus B (4783), Streptococcus ex B (4781), Yersinia (4817)

[9] Alkaline phosphatase > 200 U/L (767), chronic liver disease (809), effusion abdomen (777), total bilirubin > 9.0 mg/dL (768)

[10] Albumin < 3.0 g/dL (769), severe malnutrition (1043)

[11] Mass (1000), papilledema (2504)

[12] This group variable is based on hospital numbers starting with 8 (designated as Region 8 by CIC/MediQual Systems, Inc.; code 729) or 9 (designated as Region 9 by CIC/MediQual Systems, Inc.; code 730). The states included in the West Region Group include: CO, AZ, CA, OR, WA, NV, MT, WY, NM, ID, HI, and AK.

Table C.5. *Atlas* Variable Definitions

Variable Description	*Atlas* Code #	Definition	Source Documents
Acute Neurological Combination	600	This is an additive group variable based on the presence of any of the individual KCF variables that are part of the group. Each individual variable that is present in the record will be summed for use in the scoring calculation.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records
Admission Period Surgery	710	This variable is based on the presence of a surgical procedure episode in the admission period.	Facility-defined
Age in Months	707	This variable is based on the patient's age in months. For patients age 0-30 days, the actual number of days is divided by 30 to determine the month value. For any patients over 23 months, a value of 24 is used.	Facility-defined
Age in Years	277	This variable is based on the patient's age in years. For patients under 12 months, 0 is used; for patients 12-23 months 1 is used; for patients > 23 months, the actual age is used.	Facility-defined
Age Squared	701	This variable is based on the patient's age in years squared.	Facility-defined
Albumin g/dL	3030	This variable uses the value of an abnormal albumin < 3.0 g/dL for either a preadmission or admission KCF or imputes a normal of 4.4 for scoring. Records with a laboratory test using another unit of measure will have the result converted for scoring.	Laboratory reports
Alkaline Phosphatase U/L	3206	This variable uses the value of an abnormal alkaline phosphatase of > 200 U/L for either a preadmission or admission KCF or imputes a normal value of 58 for scoring. Records with a laboratory test using another unit of measure will have the result converted for scoring.	Laboratory reports
Anemia Group	650	This is a group variable based on the presence of any of the individual history and KCF variables that are part of the group.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records
Aspartate Aminotransferase (AST) U/L	3039	This variable uses the value of an abnormal AST of >80 U/L for either a preadmission or admission KCF or imputes a normal of 12 for scoring. Records with a laboratory test using another unit of measure will have the result converted for scoring.	Laboratory reports
Benign Tumor	1800	This variable is based on the presence of a benign tumor from any site and any source as either a preadmission or admission KCF.	Procedure reports, cytology reports, hematology bone marrow reports, pathology reports, imaging reports, radiology reports
Bleeding	1351	This variable is based on the presence of bleeding of any site as either a preadmission or admission KCF.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records, procedure notes, crystallography reports, cytology reports, hematology bone marrow reports, pathology reports, imaging reports, radiology reports

Variable Description	*Atlas* Code #	Definition	Source Documents
Blood Urea Nitrogen (BUN) mg/dL	3260	This variable uses the value of an abnormal BUN (blood urea nitrogen) of > 30 mg/dL for either a preadmission or admission KCF or imputes a normal value of 12 for scoring. Records with a laboratory test using another unit of measure will have the result converted for scoring.	Laboratory reports
Central Region Group	2613	This is a group variable based on the presence of any of the individual region variables that are part of the group. The region is identified by the first character of the facility (hospital) number. This group variable is based on hospital numbers starting with 4 (designated as Region 4 by CIC/MediQual Systems, Inc.; code 740), 5 (Region 5; code 741), 6 (Region 6; code 742), or 7 (Region 7; code 743). The states included in the Central Region Group include: IL, OH, MI, IN, WI, TN, KY, AL, MS, MN, ND, NE, IA, MO, SD, KS, LA, OK, AR, and TX.	Facility-defined
Chronic Anemia	804	This variable is based on the presence of the chronic anemia history finding.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records
Chronic Lung Disease	840	This variable is based on the presence of the chronic lung disease history finding.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records
Chronic Neurology Combination	601	This is an additive group variable based on the presence of any of the individual KCF variables that are part of the group. Each individual variable that is present in the record will be summed for use in the scoring calculation.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records
Chronic Obstructive Pulmonary/lung Disease (COPD) Group	670	This is a group variable based on the presence of any of the individual history or KCF variables that are part of the group.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records
Chronic Paresis	2101	This variable is based on the presence of chronic paresis as either a preadmission or admission KCF.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records
Coagulation Defect Group	666	This is a Congestive Heart Failure group variable based on the presence of any of the individual KCF variables that are part of the group.	Laboratory reports
Coma Group	654	This is a group variable based on the presence of any of the individual KCF variables that are part of the group.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records, graphic records, ICU flow sheets
Coma Score 3 - 15	5043	This variable uses the value of a coma score > 2 for either a preadmission or admission KCF or imputes a normal value of 15 for scoring.	ED Record, graphic records, ICU flow sheets, transport records

Variable Description	*Atlas* Code #	Definition	Source Documents
Congenital Combination	620	This is an additive group variable based on the presence of any of the individual history or KCF variables that are part of the group. Each individual variable that is present in the record will be summed for use in the scoring calculation.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records, procedure reports, pathology reports, imaging reports
Congestive Heart Failure (CHF)	1500	This variable is based on the presence of CHF as either a preadmission or admission KCF.	Procedure reports, pathology reports, imaging reports
Congestive Heart Failure (CHF) Group	664	This is a Congestive Heart Failure (CHF) group variable based on the presence of any of the individual history or KCF variables that are part of the group.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records, chest x-rays, cardiac catheterization report, echocardiogram, ICU flow sheets
Coronary Artery Disease (CAD) Group	658	This CAD (coronary artery disease) group variable is based on the presence of any of the individual KCF variables that are part of the group.	Coronary angiography, EKG reports, telemetry strips, exercise/stress tests
Creatine Phosphokinase (CPK) U/L	3060	This variable uses the value of CPK > 150 U/L for either a preadmission or admission KCF or imputes a normal value of 102 (ages > 12 yr) or > 110 (ages < 13 yr) for scoring.	Laboratory reports
Creatine Phosphokinase – Heart (CPK-MB)%	3070	This variable uses the value of CPK-MB > 3% for either a preadmission or admission KCF or imputes a normal value of 0 for scoring.	Laboratory records
Creatinine mg/dL	3080	This variable uses the value of creatinine > 1.7mg/dL for either a preadmission or admission KCF or imputes a normal of 0.9 for scoring. Records with a laboratory test using another unit of measure will have the results converted for scoring.	Laboratory reports
Culture Combination	630	This is an additive group variable based on the presence of any of the individual culture variables that are part of the group. Each individual variable that is present in the record will be summed for use in the scoring calculation.	Antibody test, antigen test, bacteriology report, CLO test, culture report, cytology report, EIA, ELISA, Helicobacter test, IgG/IgM tests, immunoassay/ immunology tests, latex agglutination test, microbiology report, pathology/serology reports, toxin assay virology report
Current Medication Anticoagulant	890	This variable is based on the presence of the current medication - anticoagulant finding.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records
Current Medication Immunosuppressive	892	This variable is based on the presence of the current medication - immunosuppressive history finding.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records

Variable Description	*Atlas* Code #	Definition	Source Documents
Current Medication Insulin	894	This variable is based on the presence of the current medication - insulin history finding.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records
Cyst	1340	This variable is based on the presence of a cyst of any site as either a preadmission or admission KCF.	Procedure reports, pathology reports, imaging reports
Damage Group, Heart	672	This is a group variable based on the presence of any of the individual KCF variables that are part of the group.	Laboratory reports, procedure reports, pathology reports, imaging reports
Diabetes	805	This variable is based on the presence of the diabetes history finding.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records
Diabetes Group	673	This is a group variable based on the presence of any of the individual history or KCF variables that are part of the group.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records, laboratory records
Diastolic BP	5024	This variable uses the value of diastolic blood pressure > 119 mm for either a preadmission or admission KCF or imputes a normal value of 80 mm (ages > 12 yr) or 59 (ages < 13 yr) for scoring.	ED Record, graphic records, ICU flow sheets, transport records
Edema	1399	This variable is based on the presence of edema of any sites as either a preadmission or admission KCF.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records, procedure reports, pathology reports, imaging reports
Effusion	1321	This variable is based on the presence of effusion of any site as either a preadmission or admission KCF.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records, procedure reports, pathology reports, imaging reports
Enlarged Heart	1700	This variable is based on the presence of an enlarged heart as either a preadmission or admission KCF.	Procedure reports, pathology reports, imaging reports
Fluid Imbalance Combination	635	This is an additive group variable based on the presence of any of the individual KCF variables that are part of the group. Each individual variable that is present in the record will be summed for use in the scoring calculation.	Laboratory reports
Gender	278	(F=0; M=1)This variable is based on the patient's gender. Males will use a value of 1 and all other patients will use a value of 0 for scoring.	Facility-defined
Glucose mg/dL High	3172	This variable uses the value of glucose > 249 mg/dL for either a preadmission or admission KCF or imputes a normal value of 80 (for ages 1 month or more) or 45 (for ages 0-30 days) for scoring. Records with a laboratory test using another unit of measure will have the result converted for scoring.	Laboratory reports

Variable Description	*Atlas* Code #	Definition	Source Documents
Hematocrit % Low	3561	This variable uses the value of hematocrit < 30% for either a preadmission or admission KCF for ages one month or more or imputes a normal value of 45.5 for scoring. For ages 0-30 days, the variable uses the value of hematocrit < 40 mg/dL or imputes a normal value of 53 for scoring. Records with a laboratory test using another unit of measure will have the result converted for scoring.	Laboratory records
Hemoglobin g/dL Low	3571	This variable uses the value of hemoglobin < 10 g/dL for either a preadmission or admission KCF for ages one month or more or imputes a normal value of 12. For ages 0-30 days, the variable uses the value of hemoglobin < 13.4 mg/dL or imputes a normal value of 12 for scoring.	Laboratory records
History of CAD (Coronary Artery Disease) Group	660	This is a group variable based on the presence of any of the individual history or KCF variables that are part of the group.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records, procedure reports, pathology reports, imaging reports
History of Cancer	810	This variable is based on the presence of the cancer history finding.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records
History of CHF (Congestive Heart Failure)	832	This variable is based on the presence of the CHF history finding.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records
Immunocompromised Group	680	This is a group variable based on the presence of any of the individual history or KCF variables that are part of the group.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records, procedure reports, pathology reports, imaging reports
Infection	1407	This variable is based on the presence of an infection of any site as either a preadmission or admission KCF.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records, procedure reports, pathology reports, imaging reports
Infection Group	682	This is a group variable based on the presence of any of the individual organism variables that are part of the group.	Cultures, immunology, serology, pathology reports,
Inflammation	1400	This variable is based on the presence of inflammation of any site as either a preadmission or admission KCF.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records, procedure reports, pathology reports, imaging reports
Inflammation Group	678	This is a group variable based on the presence of any of the individual maternal, history or KCF variables that are part of the group. Refer to the Variable Groups reference report for a listing of the specific variables.	ED Record, H&P, physician admission note, physician consults, physician progress notes, laboratory results, transfer summaries, transport records

Variable Description	*Atlas* Code #	Definition	Source Documents
Ischemia	1502	This variable is based on the presence of ischemia as either a preadmission or admission KCF.	EKG reports, rhythm and telemetry strips, EPS reports
Left Anterior Descending Artery (LAD)	1305	This variable uses the value of LAD occlusion > 49% for either a preadmission or admission KCF or imputes a normal value of 0 for scoring.	Procedure reports, pathology reports, imaging reports
Left Main Artery Disease	1308	This variable uses the value of a left main occlusion > 49% for either a preadmission or admission KCF or imputes a normal value of 0 for scoring.	Procedure reports, pathology reports, imaging reports
Lesion	1001	This variable is based on the presence of a lesion of any site as either a preadmission or admission KCF.	Procedure reports, pathology reports, imaging reports
Lethargy	2020	This variable is based on the presence of lethargy as either a preadmission or admission KCF.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records
Liver Group	684	This is a group variable based on the presence of any of the individual history or KCF variables that are part of the group. Refer to the Variable Groups reference report for a listing of the specific variables.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records, laboratory reports
Malignant Tumor	1813	This variable is based on the presence of a malignant tumor of any site as either a preadmission or admission KCF.	Procedure reports, pathology reports, imaging reports
Malnutrition Group	686	This is a group variable based on the presence of any of the individual KCF variables that are part of the group. Refer to the Variable Groups reference report for a listing of the specific variables.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records, laboratory reports
Mass Effect Group	688	This is a group variable based on the presence of any of the individual KCF variables that are part of the group.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records, procedure reports, pathology reports, imaging reports
Mechanical Ventilation - Any Days	5998	This variable is based on the presence of mechanical ventilation treatment.	Facility-defined
Mechanical Ventilation - Days	9010	This variable is based on the presence of the treatment code for mechanical ventilation. The actual number of days on the ventilator will be used for scoring. Note for patients on a ventilator < 1 day a value of 0.5 will be used. Patients not on a ventilator will have a normal of 0 imputed.	Facility-defined
Myocardial Infarction	1501	This variable is based on the presence of myocardial infarction as either a preadmission or admission KCF.	EKG reports, rhythm and telemetry strips, EPS reports
Myocardial Infarction (MI) Group	690	This is a group variable based on the presence of any of the individual KCF variables that are part of the group.	Laboratory reports, EKG reports, rhythm and telemetry strips, EPS reports

Variable Description	*Atlas* Code #	Definition	Source Documents
Non-Sinus Rhythm Group	651	This is a group variable based on the presence of any of the individual KCF variables that are part of the group.	EKG reports, ED Record, transport records, rhythm and telemetry strips, EPS reports, graphic records, ICU flow sheets
O_2 Saturation Arterial %	3323	This variable uses the value of arterial O_2 saturation < 86% for either a preadmission or admission KCF or imputes a normal of 90 for scoring.	Laboratory reports
Oral Temperature ^oF High	5002	This variable uses the value of oral temperature > 100.9 ^oF for either a preadmission or admission KCF or imputes a normal value of 98.6 ^oF for scoring. Records with another unit of measure will have the result converted for scoring.	ED Record, graphic records, ICU flow sheets, transport records
Oral Temperature ^oF Low	5001	This variable uses the value of oral temperature < 95.5 ^oF for either a preadmission or admission KCF or imputes a normal value of 98.6 ^oF for scoring. Records with another unit of measure will have the result converted for scoring.	ED Record, graphic records, ICU flow sheets, transport records
pCO_2 Arterial	3317	This variable uses the value of arterial pCO_2 > 45 for either a preadmission or admission KCF or imputes a normal value of 40 for scoring.	Laboratory reports
pH Arterial High	3302	This variable uses the value of arterial pH > 7.44 for a preadmission or admission KCF or imputes a normal of 7.38 for scoring.	Laboratory reports
pH Arterial Low	3301	This variable uses the value of arterial pH < 7.35 for either a preadmission or admission KCF or imputes a normal value of 7.38 for scoring.	Laboratory reports
pO_2 Arterial	3314	This variable uses the value of arterial pO_2 < 75 for either a preadmission or admission KCF or imputes a normal value of 75 for scoring.	Laboratory reports
Partial Thromboplastin Time (PTT) sec	3450	This variable uses the value of PTT > 35.9 for either a preadmission or admission KCF or imputes a normal value of 37.5 for scoring.	Laboratory reports
Previous CABG	831	This variable is based on the presence of a previous CABG history finding.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records
Previous Seizures	820	This variable is based on the presence of the previous seizures history finding.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records
Previous Stroke	811	This variable is based on the presence of the previous stroke history finding.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records
Prothrombin Time (PT) sec	3460	This variable uses the value of PT > 15.5 seconds for either a preadmission or admission KCF or imputes a normal of 12 for scoring.	Laboratory reports

Variable Description	*Atlas* Code #	Definition	Source Documents
Pulse High	5012	This variable uses the value of pulse > 129 for either a preadmission or admission KCF or imputes a normal value of 80 (ages > 12 yr) or 100 (ages < 13 yr) for scoring.	ED Record, graphic records, ICU flow sheets transport records
Pulse Low	5011	This variable uses the value of pulse < 65 for either a preadmission or admission KCF or imputes a normal value of 80 (ages > 12 yr) or 100 (ages < 13 yr) for scoring.	ED Record, graphic records, ICU flow sheets, transport records
Regurgitation	5506	This variable is based on the presence of regurgitation as either a preadmission or admission KCF.	Procedure reports, pathology reports, imaging reports
Renal Group	692	This is a group variable based on the presence of any of the individual history or KCF variables that are part of the group.[†]	ED Record, H&P, physician admission note, physician consults, physicians progress notes, transfer summaries, transport records, laboratory reports
Respirations High	5032	For ages ≥ 1 month, this variable uses the value of respirations > 24 for either a preadmission or admission KCF or imputes a normal value of 18. For ages 0 – 30 days, the value of respirations > 70 is ascribed or a normal value of 35 is impute for scoring.	ED Record, graphic records, ICU flow sheets, transport records
Resuscitation	9000	This variable is based on the presence of the treatment code for resuscitation.	Facility-defined
Right Coronary Artery (RCA)	1310	This variable uses the value of a right coronary artery occlusion > 49% for either a preadmission or admission KCF or imputes a normal value of 0 for scoring.	Procedure reports, pathology reports, imaging reports
S3 Gallop	5524	This variable is based on the presence of S3 gallop as either a preadmission or admission KCF.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records
Seizure Group	694	This is a group variable based on the presence of any of the individual history or KCF variables that are part of the group.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records
Severe Malnutrition	1043	This variable is based on the presence of severe malnutrition as either a preadmission or admission KCF.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records
Stenosis	1373	This variable is based on the presence of stenosis of any site as either a preadmission or admission KCF.	Procedure reports, pathology reports, imaging reports
Syncope	822	This variable is based on the presence of the syncope history finding.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transfer summaries, transport records

Variable Description	*Atlas* Code #	Definition	Source Documents
Systolic BP Low	5021	This variable uses the value of systolic blood pressure < 90 mm (for ages > 17 yr) or < 60 mm (for ages < 18 yr) for either a preadmission or admission KCF or imputes a normal of 110 mm for scoring.	ED Record, graphic records, ICU flow sheets, transport records
Total Bilirubin mg/dL	3048	This variable uses the value of total bilirubin > 2.0 mg/dL for either a preadmission or admission KCF for ages one month or more or imputes a normal value of 0.6. For ages 0-30 days, the variable uses the value of total bilirubin > 9.9 mg/dL or imputes a normal value of 6.5 for scoring. Records with another unit of measure will have the result converted for scoring.	Laboratory records
Uterine Prolapse > Grade 1	1777	This variable is based on the presence of uterine prolapse > grade 1 as either a preadmission or admission KCF.	ED Record, H&P, physician admission note, physician consults, physician progress notes, transport records, procedure reports, pathology reports, imaging reports
West Region Group	2614	This is a group variable based on the presence of any of the individual region variables that are part of the group.[†] The region is identified by the first character of the facility (hospital) number. This group variable is based on hospital numbers starting with 8 (designated as Region 8 by CIC/MediQual Systems, Inc.; code 729) or 9 (designated as Region 9 by CIC/MediQual Systems, Inc.; code 730). The states included in the West Region Group include: CO, AZ, CA, OR, WA, NV, MT, WY, NM, ID, HI, and AK.	Facility-defined
White Blood Cell (WBC) High	3662	This variable uses the value of whit blood cell count (WBC) > 17.0 for either a preadmission or admission KCF or imputes a normal value of 7.5 (ages one month or more) or 21 (ages 0-30 days) for scoring. Records with another unit of measure will have the result converted for scoring.	Laboratory reports
White Blood Cell (WBC) Low	3661	This variable uses the value of whit blood cell count (WBC) < 5.0 for either a preadmission or admission KCF or imputes a normal value of 7.5 (ages one month or more) or 21 (ages 0-30 days) for scoring. Records with another unit of measure will have the result converted for scoring.	Laboratory reports

APPENDIX D: DEFINITION OF IN-HOSPITAL COMPLICATIONS FOR HYSTERECTOMY

Clinical Categories Listed Highest to Lowest Volume by Abdominal Approach

Complication Category	Abdominal Approach # of Cases†	Abdominal Approach % of Cases†	Abdominal Approach Average LOS	Vaginal Approach # of Cases†	Vaginal Approach % of Cases†	Vaginal Approach Average LOS
• Procedure/medical care related events	541	4.4%	4.3	180	3.1%	3.2
• Digestive system complications	384	3.1%	5.1	84	1.4%	2.9
• Urinary tract infection/complications	293	2.4%	4.8	136	2.3%	2.9
• Postoperative pulmonary compromise	279	2.3%	5.1	55	0.9%	3.6
• Postoperative hemorrhage	220	1.8%	4.8	89	1.5%	3.7
• Postoperative infection	113	0.9%	6.2	21	0.4%	6.3
• Postoperative pneumonia	37	0.3%	8.6	2	0.0%	5.0
• Postoperative cardiac complications	30	0.2%	4.7	9	0.2%	2.4
• Postoperative venous thrombosis/ pulmonary embolism	25	0.2%	6.7	3	0.1%	4.0
• Hypo/hypertension	22	0.2%	3.3	15	0.3%	2.6
• Postoperative stroke/anoxic brain damage	3	0.0%	6.7	3	0.1%	4.0
• Gastric/intestinal hemorrhage or ulceration	2	0.0%	7.5	0	0	0
• ***With any complication above***	1,684	13.6%	4.5	546	9.3%	3.0
• ***Without any complication above***	10,688	86.4%	2.9	5,353	90.7%	2.0

† The term “cases” refers to hospitalizations

APPENDIX D CONTINUED

Listing of Specific ICD.9.CM Codes

Type of Complication	ICD.9.CM Code
Procedure/Medical Care Related Events	
accidental puncture or laceration during a procedure	998.2
disruption of operation wound	998.3
foreign body accidentally left during a procedure	998.4
other specified complications of procedures	998.89
other transfusion reaction	999.8
persistent postoperative fistula	998.6
postoperative shock	998.0
Digestive System Complications	
digestive system complications (e.g. hepatic failure, intestinal obstruction)	997.4
Urinary Tract Infection/Complications	
urinary complications (e.g. acute renal failure, oliguria, anuria)	997.5
urinary tract infection, site not specified	599.0
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 pulmonary insufficiency, not elsewhere classified	518.82
pulmonary congestion and hypostasis	518.4
pulmonary insufficiency following trauma & surgery	518.5
respiratory complications (e.g. aspiration pneumonia, Mendelson's syndrome)	997.3
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
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

APPENDIX D CONTINUED

Listing of Specific ICD.9.CM Codes

Type of Complication	ICD.9.CM Code
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
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
Hypotension/Hypertension	
hypertension, not elsewhere classified	997.91
iatrogenic hypotension	458.2
Postoperative Stroke/Anoxic Brain Damage	
central nervous system complications (e.g. anoxic brain damage, cerebral hypoxia)	997.01
iatrogenic cerebrovascular infarction or hemorrhage	997.02
nervous system complication, unspecified	997.00
other nervous system complications	997.09
Gastric/Intestinal Hemorrhage or Ulceration	
control of (postoperative) hemorrhage of anus	49.95 (procedure)

APPENDIX D CONTINUED

Listing of Specific ICD.9.CM Codes

Type of Complication	ICD.9.CM Code
Gastric/Intestinal Hemorrhage or Ulceration continued	
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 CONSIDERED

Asthma - Adult
Hospitalizations under age 65

Variable and Codes	Statewide				HMO			
	Cases * N = 9,231		Ave LOS	Readmis-sions	Cases * N = 2,030		Ave LOS	Readmis-sions
	n	%		%	*n*	%		%
Age								
18 - 28 years	1,516	16.4	2.5	13.0	316	15.6	2.5	8.5
29 - 55 years	6,230	67.5	3.5	17.4	1,417	69.8	3.4	11.2
56 - 64 years	1,485	16.1	4.1	15.0	297	14.6	3.8	8.4
mean age: 42.1 (state & HMO)								
Asthma Type *(principal diagnosis)*								
w/status asthmaticus (493.01, 493.11, 493.21, 493.91)	3,789	41.0	3.6	16.8	763	37.6	3.5	10.8
w/o status asthmaticus (493.00, 493.10, 493.20, 493.90)	5,442	59.0	3.3	15.9	1,267	62.4	3.2	10.2
***Atlas* Admission Severity Group** *(ASG)*								
0	6,390	69.2	3.2	14.1	1,523	75.0	3.2	8.7
1	1,454	15.8	3.9	18.5	290	14.3	4.0	14.8
2	782	8.5	4.5	25.7	120	5.9	4.0	20.0
3	62	0.7	6.3	35.5	12	0.6	8.2	16.7
4	1	0.0	1.0	0.0	0	0.0	0.0	0.0
missing	542	5.9	3.1	20.3	85	4.2	3.1	10.6
***Atlas* Predicted LOS Group**								
0 (below 2.938)	182	2.0	2.3	9.9	41	2.0	2.3	12.2
1 (2.938 – 3.393)	1,153	12.5	2.5	12.5	268	13.2	2.5	7.8
2 (3.394 – 5.124)	5,763	62.4	3.4	15.0	1,369	67.4	3.4	9.7
3 (5.125 – 6.386)	1,168	12.7	4.3	21.2	213	10.5	4.2	16.0
4 (above 6.386)	423	4.6	5.2	28.4	54	2.7	5.2	16.7
missing	542	5.9	3.1	20.3	85	4.2	3.1	10.6
Chronic Obstructive Asthma *(principal diagnosis)*								
no	7,595	82.3	3.2	14.5	1,766	87.0	3.2	9.4
yes (493.20, 493.21)	1,636	17.7	4.3	24.6	264	13.0	4.2	17.1
Diabetes								
none	8,055	87.3	3.3	15.7	1,839	90.6	3.3	9.9
diabetes w/o complication (250.0x)	1,058	11.5	4.1	19.9	172	8.5	3.7	15.1
diabetes w/ complication (250.1x – 250.9x)	118	1.3	4.8	25.4	19	0.9	5.4	15.8
Gender								
male	2,293	24.8	3.1	18.8	478	23.5	2.9	11.5
female	6,938	75.2	3.5	15.5	1,552	76.5	3.5	10.1

* Cases after exclusions; the term "cases" refers to hospitalizations.
Source: PA Health Care Cost Containment Council, July 1, 1998 to June 30, 1999 inpatient hospital discharges

APPENDIX E CONTINUED

Asthma – Adult continued
Hospitalizations under age 65

Variable and Codes	Statewide				HMO			
	Cases * N = 9,231		Ave LOS	Readmis-sions	Cases * N = 2,030		Ave LOS	Readmis-sions
	n	%		%	*n*	%		%
Heart Failure								
no	8,937	96.8	3.4	15.9	1,988	97.9	3.3	10.3
yes	294	3.2	4.9	28.2	42	2.1	3.9	14.3
(398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0 - 428.9)								
Mechanical Ventilation								
no	9,047	98.0	3.4	16.2	1,995	98.3	3.3	10.4
yes (procedure codes 96.70 – 96.72)	184	2.0	6.3	22.3	35	1.7	7.1	11.4
Race								
white	5,514	59.7	3.6	13.7	1,459	71.9	3.4	9.5
black	2,221	24.1	3.2	22.0	378	18.6	3.2	12.2
other/unknown race	1,496	16.2	3.4	17.3	193	9.5	3.4	13.5

* Cases after exclusions; the term “cases” refers to hospitalizations.
Source: PA Health Care Cost Containment Council, July 1, 1998 to June 30, 1999 inpatient hospital discharges

APPENDIX E CONTINUED

Asthma - Pediatric
Hospitalizations under age 18

Variable and Codes	Statewide			HMO		
	Cases * N = 6,666		Ave LOS	Cases * N = 1,200		Ave LOS
	n	%		*n*	%	
Age						
28 days - less than 1 year	718	10.8	2.5	91	7.6	2.2
1 - 11 years	4,864	73.0	2.1	876	73.0	1.9
12 - 17 years	1,084	16.3	2.5	233	19.4	2.4
mean age: 5.7 (state), 6.4 (HMO)						
Asthma Type *(principal diagnosis)*						
w/status asthmaticus (493.01, 493.11, 493.21, 493.91)	4,590	68.9	2.2	779	64.9	2.1
w/o status asthmaticus (493.00, 493.10, 493.20, 493.90)	2,076	31.1	2.1	421	35.1	2.0
***Atlas* Admission Severity Group** *(ASG)*						
0	5,863	88.0	2.2	1,136	94.7	2.0
1	21	0.3	3.2	2	0.2	4.0
2	5	0.1	2.6	1	0.1	3.0
3	0	0.0	0.0	0	0.0	0.0
4	3	0.1	12.3	0	0.0	0.0
missing	774	11.6	2.1	61	5.1	2.0
***Atlas* Predicted LOS Group**						
0 (below 2.442)	110	1.7	1.7	24	2.0	1.7
1 (2.442 – 2.583)	767	11.5	1.8	138	11.5	1.6
2 (2.584 – 3.214)	3,937	59.1	2.1	800	66.7	2.1
3 (3.215 – 3.730)	785	11.8	2.5	138	11.5	2.1
4 (above 3.730)	293	4.4	3.9	39	3.3	3.2
missing	774	11.6	2.1	61	5.1	2.0
Gender						
male	4,101	61.5	2.1	744	62.0	1.9
female	2,565	38.5	2.2	456	38.0	2.2
Mechanical Ventilation						
no	6,626	99.4	2.1	1,195	99.6	2.0
yes (procedure codes 96.70 – 96.72)	40	0.6	7.0	5	0.4	4.6
Race						
white	3,062	45.9	2.2	806	67.2	2.1
black	2,656	39.8	2.1	293	24.4	1.9
other/unknown race	948	14.2	2.2	101	8.4	2.0

* Cases after exclusions; the term “cases” refers to hospitalizations.
Source: PA Health Care Cost Containment Council, July 1, 1998 to June 30, 1999 inpatient hospital discharges

APPENDIX E CONTINUED

AMI
Hospitalizations under age 65

Variable and Codes	Statewide				HMO			
	Cases * N = 12,138		Mortality	Ave LOS	Cases * N = 3,196		Mortality	Ave LOS
	n	%	%		*n*	%	%	
Age								
18 - 44 years	1,703	14.0	1.7	4.3	465	14.5	2.2	3.9
45 - 61 years	8,425	69.4	3.4	4.7	2,316	72.5	2.7	4.5
62 - 64 years	2,010	16.6	6.6	5.6	415	13.0	3.1	5.3
mean age: 53.4 (state), 52.7 (HMO)								
***Atlas* Admission Severity Group** *(ASG)*								
0	128	1.1	0.0	3.3	37	1.2	0.0	3.0
1	5,994	49.4	0.4	3.9	1,745	54.6	0.6	3.9
2	4,506	37.1	2.4	5.2	1,081	33.8	2.3	4.9
3	914	7.5	17.2	8.4	199	6.2	12.6	7.7
4	220	1.8	64.1	7.1	41	1.3	58.5	7.2
missing	376	3.1	3.2	5.0	93	2.9	2.2	4.1
Cardiomyopathy								
no	11,824	97.4	3.5	4.7	3,151	98.6	2.6	4.5
yes (425.3, 425.4, 425.8, 425.9)	314	2.6	10.2	7.4	45	1.4	8.9	6.1
Drug Abuse								
none	11,969	98.6	3.7	4.8	3,181	99.5	2.7	4.5
drug psychoses, dependence or abuse (292.0-292.9, 304.x, 305.2-305.9, px94.64-px94.69)	169	1.4	3.6	5.8	15	0.5	0.0	5.3
Gender								
male	8,832	72.8	2.8	4.7	2,358	73.8	2.3	4.4
female	3,306	27.2	5.9	5.3	838	26.2	3.9	4.6
Heart Failure								
no	10,108	83.3	2.6	4.2	2,808	87.9	1.8	4.1
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)	2,030	16.7	9.3	8.0	388	12.1	9.0	7.0
MI Type *(principal diagnosis)*								
Q-Wave (410x1 except 410.71)	7,521	62.0	4.7	4.8	1,989	62.2	3.8	4.5
non-Q-Wave (410.71)	4,617	38.0	2.0	4.8	1,207	37.8	0.9	4.4

* Cases after exclusions; the term "cases" refers to hospitalizations.
Source: PA Health Care Cost Containment Council, July 1, 1998 to June 30, 1999 inpatient hospital discharges

APPENDIX E CONTINUED

AMI continued
Hospitalizations under age 65

Variable and Codes	Statewide				HMO			
	Cases *		Mortality	Ave LOS	Cases *		Mortality	Ave LOS
	N = 12,138				*N = 3,196*			
	n	%	%		*n*	%	%	
Race								
white	9,568	78.8	3.5	4.7	2,627	82.2	2.5	4.4
black	765	6.3	5.2	5.6	154	4.8	2.0	5.3
other/unknown race	1,805	14.9	4.2	5.3	415	13.0	4.1	5.1
Renal Dialysis								
no	11,965	98.6	3.5	4.8	3,171	99.2	2.5	4.5
yes	173	1.4	15.0	8.4	25	0.8	24.0	7.7
(v45.1, v56.0, v56.8, procedure codes 39.95, 54.98)								
Renal Failure – Chronic (includes hypertension w/ renal failure)								
no	11,787	97.1	3.4	4.7	3,143	98.3	2.6	4.4
yes	351	2.9	14.3	7.8	53	1.7	9.4	7.6
(403.01, 403.11, 403.91, 404.02, 404.12, 404.92, 585)								

* Cases after exclusions; the term “cases” refers to hospitalizations.
Source: PA Health Care Cost Containment Council, July 1, 1998 to June 30, 1999 inpatient hospital discharges

APPENDIX E CONTINUED

Heart Failure
Hospitalizations under age 65

Variable and Codes	Statewide					HMO				
	Cases * N = 12,245		Mortality	Ave LOS	Readmis-sions	Cases * N = 1,798		Mortality	Ave LOS	Readmis-sions
	n	%	%		%	*n*	%	%		%
Age										
18-34 years	358	2.9	1.1	4.5	23.2	42	2.3	0.0	6.1	7.1
35-44 years	1,240	10.1	1.9	5.0	22.5	151	8.4	1.3	5.1	12.6
45-54 years	3,285	26.8	1.6	5.5	19.8	525	29.2	1.0	5.0	14.9
55-64 years	7,362	60.1	2.3	5.9	19.8	1,080	60.1	1.9	5.4	13.7
mean age: 54.5 (state) 54.7 (HMO)										
***Atlas* Admission Severity Group** *(ASG)*										
0	66	0.5	1.5	4.8	16.7	11	0.6	0.0	5.0	9.1
1	3,242	26.5	0.5	4.6	15.9	539	30.0	0.7	4.3	10.4
2	6,549	53.5	1.5	5.6	20.4	951	52.9	1.6	5.1	13.8
3	1,545	12.6	6.7	7.9	26.5	184	10.2	2.7	8.1	24.5
4	61	0.5	29.5	13.6	18.0	7	0.4	42.9	12.4	0.0
missing	782	6.4	1.8	5.9	23.5	106	5.9	0.9	6.8	14.2
Cardiomyopathy										
no	9,003	73.5	2.0	5.4	19.7	1,247	69.4	1.4	4.9	13.0
yes (425.3, 425.4, 425.8, 425.9)	3,242	26.5	2.3	6.4	21.4	551	30.6	1.8	6.1	15.6
Diabetes										
none	6,650	54.3	2.4	5.7	18.9	989	55.0	1.7	5.4	12.6
diabetes w/o complication (250.0x)	3,940	32.2	1.6	5.1	20.8	599	33.3	1.2	4.8	14.7
diabetes w/ complication (250.1x – 250.9x)	1,655	13.5	2.1	6.8	23.8	210	11.7	1.9	6.3	16.7
Gender										
male	6,882	56.2	2.3	5.7	20.3	1,088	60.5	1.5	5.4	14.4
female	5,363	43.8	1.8	5.7	19.9	710	39.5	1.7	5.2	12.8
Race										
white	7,196	58.8	2.4	5.8	18.0	1,175	65.4	1.8	5.3	12.3
black	3,448	28.2	1.1	5.2	24.5	430	23.9	0.9	4.5	16.5
other/unknown race	1,601	13.1	2.8	6.3	20.7	193	10.7	1.6	6.9	16.6
Renal Dialysis										
no	11,140	91.0	2.0	5.7	19.8	1,715	95.4	1.5	5.2	13.6
yes (v45.1, v56.0, v56.8, procedure codes 39.95, 54.98)	1,105	9.0	2.7	5.8	23.7	83	4.6	3.6	7.4	16.9

* Cases after exclusions; the term "cases" refers to hospitalizations.
Source: PA Health Care Cost Containment Council, July 1, 1998 to June 30, 1999 inpatient hospital discharges

APPENDIX E CONTINUED

Heart Failure continued
Hospitalizations under age 65

Variable and Codes	Statewide					HMO				
	Cases * N = 12,245		Mortality	Ave LOS	Readmis-sions	Cases * N = 1,798		Mortality	Ave LOS	Readmis-sions
	n	%	%		%	*n*	%	%		%
Renal Failure - Chronic										
no	11,588	94.6	1.9	5.6	19.8	1,731	96.3	1.4	5.2	13.9
yes (585)	657	5.4	5.5	7.0	26.3	67	3.7	6.0	6.4	10.5

* Cases after exclusions; the term “cases” refers to hospitalizations.
Source: PA Health Care Cost Containment Council, July 1, 1998 to June 30, 1999 inpatient hospital discharges

APPENDIX E CONTINUED

Hysterectomy (Non-malignant/Non-emergent)
Statewide Hospitalizations under age 65

Variable and Codes	Statewide							
	Abdominal				Vaginal			
	Cases * N = 12,831		Ave LOS	Compli-cations	Cases * N = 6,057		Ave LOS	Compli-cations
	n	%		%	*n*	%		%
Age								
18-40 years	3,973	31.0	3.0	13.4	2,130	35.2	2.0	8.3
41-46 years	4,470	34.8	3.1	13.8	1,722	28.4	2.1	9.6
47-64 years	4,388	34.2	3.2	13.9	2,205	36.4	2.3	10.3
mean age: 43.8 (abdominal), 44.2 (vaginal)								
***Atlas* Admission Severity Group** *(ASG)*								
0	11,841	92.3	3.1	13.5	5,740	94.8	2.1	9.2
1	457	3.6	3.9	16.2	137	2.3	2.3	10.2
2	50	0.4	5.2	18.0	12	0.2	2.4	25.0
3	10	0.1	6.3	40.0	5	0.1	1.6	0.0
4	14	0.1	6.3	14.3	5	0.1	2.0	40.0
missing	459	3.6	3.3	16.1	158	2.6	2.2	14.6
***Atlas* Predicted LOS Group** (definition used in adjusting for ave. LOS)								
0 (below 2.421)	229	1.8	2.7	12.2	174	2.9	1.9	13.2
1 (2.421 – 2.701)	1,564	12.2	2.9	11.7	852	14.1	1.9	8.1
2 (2.702 – 3.534)	8,479	66.1	3.0	13.1	3,655	60.3	2.1	9.0
3 (3.535 – 3.950)	1,433	11.2	3.3	16.7	997	16.5	2.4	10.1
4 (above 3.950)	667	5.2	4.6	18.1	221	3.7	2.6	11.3
missing	459	3.6	3.3	16.1	158	2.6	2.2	14.6
***Atlas* Predicted LOS Group** (definition used in adjusting for complications)								
0 (below 2.702)	1,793	14.0	2.9	11.8	1,026	16.9	1.9	9.0
1 (2.702 – 3.536)	8,488	66.2	3.0	13.1	3,656	60.4	2.1	9.0
2 (above 3.536)	2,091	16.3	3.7	17.2	1,217	20.1	2.4	10.4
missing	459	3.6	3.3	16.1	158	2.6	2.2	14.6
Diabetes								
none	12,379	96.5	3.1	13.6	5,908	97.5	2.1	9.4
diabetes w/o complication (250.0x)	419	3.3	3.7	15.5	144	2.4	2.4	7.6
diabetes w/ complication (250.1x – 250.9x)	33	0.3	3.8	12.1	5	0.1	2.6	20.0
History of Cancer								
no	12,619	98.3	3.1	13.7	5,967	98.5	2.1	9.4
yes (v10.00 – v10.9)	212	1.7	3.1	14.6	90	1.5	2.0	8.9

* Cases after exclusions; the term "cases" refers to hospitalizations.
Source: PA Health Care Cost Containment Council, July 1, 1998 to June 30, 1999 inpatient hospital discharges

APPENDIX E CONTINUED

Hysterectomy (Non-malignant/Non-emergent)
Statewide Hospitalizations under age 65

Variable and Codes	Statewide							
	Abdominal				Vaginal			
	Cases * N = 12,831		Ave LOS	Compli-cations	Cases * N = 6,057		Ave LOS	Compli-cations
	n	%		%	*n*	%		%
Principal Diagnosis Groupings								
fibroids/hyperplasia/endometriosis (218.x, 621.2, 621.3, 617.x, not including 617.5)	8,640	67.3	3.0	14.0	2,287	37.8	2.0	9.0
uterine prolapse (618.1 – 618.4)	206	1.6	3.2	18.0	1,860	30.7	2.4	10.5
bleeding abnormalities & other principal diagnoses (626.2-626.9, 627.0, 627.1 for bleeding abnormalities)	3,985	31.1	3.3	13.0	1,910	31.5	2.0	8.8
Race								
white	9,606	74.9	3.0	12.3	4,924	81.3	2.1	9.1
black	1,331	10.4	3.6	21.9	327	5.4	2.3	15.9
other/unknown race	1,894	14.8	3.2	15.0	806	13.3	2.2	8.6

* Cases after exclusions; the term “cases” refers to hospitalizations.
Source: PA Health Care Cost Containment Council, July 1, 1998 to June 30, 1999 inpatient hospital discharges

APPENDIX E CONTINUED

Hysterectomy (Non-malignant/Non-emergent)
HMO Hospitalizations under age 65

Variable and Codes	HMO							
	Abdominal				Vaginal			
	Cases * N = 4,156		Ave LOS	Compli-cations	Cases * N = 1,935		Ave LOS	Compli-cations
	n	%		%	*n*	%		%
Age								
18-40 years	1,302	31.3	3.0	13.3	715	37.0	2.0	10.1
41-46 years	1,543	37.1	3.0	12.7	593	30.6	2.1	9.3
47-64 years	1,311	31.5	3.1	14.6	627	32.4	2.2	12.1
mean age: 43.5 (abdominal), 43.7 (vaginal)								
Atlas* Admission Severity Group *(ASG)								
0	3,887	93.5	3.0	13.3	1,840	95.1	2.1	10.2
1	121	2.9	3.9	20.7	37	1.9	2.3	16.2
2	7	0.2	3.6	14.3	3	0.2	2.0	66.7
3	3	0.1	4.7	33.3	2	0.1	1.5	0.0
4	3	0.1	3.3	33.3	0	0.0	0.0	0.0
missing	135	3.3	3.0	10.4	53	2.7	2.2	15.1
***Atlas* Predicted LOS Group** (definition used in adjusting for ave. LOS)								
0 (below 2.421)	66	1.6	2.8	9.1	55	2.8	2.0	12.7
1 (2.421 – 2.701)	529	12.7	2.8	11.7	275	14.2	2.0	9.5
2 (2.702 – 3.534)	2,820	67.9	3.0	13.0	1,221	63.1	2.1	9.8
3 (3.535 – 3.950)	434	10.4	3.3	18.4	279	14.4	2.3	12.9
4 (above 3.950)	172	4.1	4.2	18.0	52	2.7	2.8	11.5
missing	135	3.3	3.0	10.4	53	2.7	2.2	15.1
***Atlas* Predicted LOS Group** (definition used in adjusting for complications)								
0 (below 2.702)	595	14.3	2.8	11.4	330	17.1	2.0	10.0
1 (2.702 – 3.536)	2,823	67.9	3.0	13.0	1,221	63.1	2.1	9.8
2 (above 3.536)	603	14.5	3.6	18.4	331	17.1	2.4	12.7
missing	135	3.2	3.0	10.4	53	2.7	2.2	15.1
Diabetes								
none	4,031	97.0	3.0	13.6	1,882	97.3	2.1	10.6
diabetes w/o complication (250.0x)	119	2.9	3.1	10.9	51	2.6	2.2	5.9
diabetes w/ complication (250.1x – 250.9x)	6	0.1	3.5	16.7	2	0.1	3.0	0.0
History of Cancer								
no	4,091	98.4	3.0	13.4	1,904	98.4	2.1	10.4
yes (v10.00 – v10.9)	65	1.6	3.1	15.4	31	1.6	1.8	16.1

* Cases after exclusions; the term "cases" refers to hospitalizations.
Source: PA Health Care Cost Containment Council, July 1, 1998 to June 30, 1999 inpatient hospital discharges

APPENDIX E CONTINUED

Hysterectomy (Non-malignant/Non-emergent)
HMO Hospitalizations under age 65

Variable and Codes	HMO							
	Abdominal				Vaginal			
	Cases * N = 4,156		Ave LOS	Compli-cations	Cases * N = 1,935		Ave LOS	Compli-cations
	n	%		%	*n*	%		%
Principal Diagnosis Groupings								
fibroids/hyperplasia/endometriosis (218.x, 621.2, 621.3, 617.x, not including 617.5)	2,855	68.7	3.0	14.3	761	39.3	2.0	9.7
uterine prolapse (618.1 – 618.4)	60	1.4	3.5	23.3	548	28.3	2.4	12.6
bleeding abnormalities & other principal diagnoses (626.2-626.9, 627.0, 627.1 for bleeding abnormalities)	1,241	29.9	3.1	11.1	626	32.4	2.0	9.6
Race								
white	3,215	77.4	3.0	12.2	1,610	83.2	2.1	9.9
black	529	12.7	3.4	20.2	117	6.0	2.3	14.5
other/unknown race	412	9.9	3.2	14.6	208	10.8	2.2	12.5

* Cases after exclusions; the term “cases” refers to hospitalizations.
Source: PA Health Care Cost Containment Council, July 1, 1998 to June 30, 1999 inpatient hospital discharges