



ECR® Manual

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Overview & Purpose of This Document

Evidence-Informed Case Rates®, or ECRs®, are patient-specific, severity-adjusted bundles of services during a defined time period for the treatment of specific conditions. ECR® methodology was developed by the Prometheus Payment design team (www.prometheuspayment.org) and is the property of the Health Care Incentives Improvement Institute, Inc (www.hci3.org) a nonprofit organization devoted to improving healthcare quality by creating and implementing programs that deliver positive financial incentives for providers that deliver high value care.

This document includes two parts:

Part I outlines the ECR® analysis methodology that has been used to create the ECRs®, the automated SAS programs and the risk-adjustment payment models.

Part II contains step-by-step instructions on how to format your data and run the Prometheus ECR® automated programs to calculate ECR® budgets using healthcare claims data and SAS® Software.

This methodology and instructions have been applied to create the following ECRs.

ECR® Category	ECR® Description	ECR® Name
Chronic Medical ECR® (CH)	Asthma	ASTHMA
	Chronic Obstructive Pulmonary Disease	COPD
	Congestive Heart Failure	CHF
	Coronary Artery Disease	CAD
	Diabetes	DM
	Hypertension	HTN
	Gastro-esophageal Reflux Disease	GERD
Inpatient Procedural ECR® (IPP)	Hip Replacement	HIPR
	Knee Replacement	KNEE
	Coronary Artery Bypass Graft	CABG
	Bariatric Surgery	BARI
	Colon Resection	COLON
Inpatient Medical ECR® (IM)	Acute Myocardial Infarction	AMI
	Pneumonia	PNE
	Stroke	STR
Outpatient Procedural ECR® (OPP)	Coronary Angioplasty	PCI
	Cholecystectomy	GALL
	Hysterectomy	HYST
	Knee Arthroscopy	KNRP
	Colonoscopy	COLOS
	Pregnancy and Delivery	PREG

Programmers who only aim to run the Prometheus programs can skip Part I and start reading from Part II.

Part I ECR Analysis Methodology

This Section outlines the analysis plan, the methods, the steps and the logic used to create the Prometheus ECR® analysis datasets and the full ECR price within the Prometheus ECR® V3.5 automated standard SAS programs. Separate All_codes files exist for each ECR® that map the ICD-9 diagnosis codes, the procedure codes, the CPT codes, the revenue codes as well as the NDC codes to the triggers, the typical, PACs as well as exclusion codes within each ECR®. This logic is translated into the Metadata supplied with the SAS programs. Therefore, none of the steps defined in this section need to be performed by a user using the V3.5 standard SAS programs and the Metadata supplied.

1. Data Cleaning and Preparation

Before construction of each individual ECR®, the following procedures are conducted on the input data for data cleaning and preparation.

1.1 Removing Claims Outside the Study Period

If both the service start dates and service end dates on a claim are before the start or after the end of the study period, the claim is excluded. However, if either one of the service start dates or service end dates fall inside the study period, the claim is still included for the study period.

1.2 Removing Claims with Outlier Costs

Reasonable claim-level allowed amount ranges are defined as:

Outpatient facility/professional claim:	\$10-\$1,000,000
Inpatient stay claim:	\$50-\$1,000,000
Pharmacy claim:	\$1-\$1,000,000

Claims that are out of above ranges are excluded as outlier claims. The programs allow flexibility to allow users to change the ranges to different values.

1.3 Removing Claims with Invalid Service Dates

- For outpatient facility/professional claims, if both service start date (FROM_DATE_S) and service end date (THRU_DATE_S) are missing, or if the duration between the service start and service end date is more than 100 days, the claim is excluded as an invalid claim.
- For inpatient stay claims, if one or both of the service start date and service end date are missing, the claim is excluded as an invalid claim.

1.4 Imputing Missing Service Dates

For outpatient facility/professional claims, if either the service start date or service end date is missing – the missing date is imputed using the other service date that is available.

1.5 Assigning CCS Codes and Prometheus Drug ID Codes

- For all medical claims (inpatient/outpatient facility or professional claims), each ICD-9-CM diagnosis/procedure code and HCPCS/CPT code is assigned a corresponding mapped CCS (Clinical Classification Software) code or a CCS for CPT code both created by the Agency for Healthcare Research and Quality (AHRQ) .
- For all pharmacy claims, each NDC code is assigned with a Prometheus drug ID category code.

A data summary report is created to summarize the total volume of the input data and the claims remaining after the data cleaning procedure.

2. ECR® Construction

After data cleaning and preparation, each ECR® is constructed using the following steps:

2.1 Identifying Triggers

2.1.1 Trigger Identification Method

A trigger is defined as the index claim that starts a new ECR®. The trigger is identified through ICD-9 diagnosis codes alone or in combination with ICD-9 procedure codes or HCPCS/CPT codes that had been listed in the “triggers” tab of the ECR® All_codes file. Trigger identification methods for different types of ECRs® are summarized in table 2.

Table 2. Trigger Identification Method			
ECR® Category	Trigger ICD-9 diagnosis code		Trigger ICD-9 procedure code OR trigger HCPCS/CPT code (any position)
Chronic Medical ECR® (CH)	Outpatient facility or professional claims (any position)		
Inpatient Procedural ECR® (IPP)	Inpatient stay claims (principal dx)	AND	Inpatient stay claims
	OR		
	Inpatient stay claims (principal dx)	AND	Outpatient facility or professional claims
Inpatient Medical ECR® (IM)	Inpatient stay claims (principal dx)		
Outpatient Procedural ECR® (OPP)	Inpatient stay claims (principal dx)	AND	Inpatient stay claims
	OR		
	Inpatient stay claims (principal dx)	AND	Professional claims
	OR		
	Outpatient facility claims (any position)	AND	Outpatient facility claims
	OR		
	Outpatient facility claims (any position)	AND	Professional claims

For triggers identified within inpatient stay claims alone (IPP, OPP) or within outpatient facility claims alone (OPP), both trigger diagnosis and procedure codes must come from the same claim.

For triggers identified through diagnosis code from inpatient stay claims and procedure code from outpatient facility/professional claims (IPP), or diagnosis code from inpatient stay/outpatient facility claims and procedure code from professional claims (OPP), the service date (THRU_DATE_S) on the procedure claims must be within ± 2 days of the admission to discharge period of the trigger diagnosis claims. Users are allowed to change the 2 day grace period to other values.

2.1.2 Emergency Room Visits as Triggers/Exclusions

Table 3 gives the logic for emergency room visits and defines if they are excluded from triggers or classified as typical or PACs for readmissions and associated admissions.

ECR® Category	ECR®*	ER in trigger claims	ER after-trigger claims
Chronic Medical ECR® (CH)	ASTHMA	Exclude trigger	PAC
	COPD	Exclude trigger	PAC
	CHF	Exclude trigger	PAC
	CAD	Exclude trigger	Based on codes
	DM	Exclude trigger	PAC
	HTN	Exclude trigger	PAC
	GERD	Exclude trigger	Based on codes
Inpatient Procedural ECR® (IPP)	HIPR	Exclude episode	PAC
	KNEE	Exclude episode	PAC
	CABG	Typical risk factor*	PAC
	BARI	Exclude episode	PAC
	COLON	Typical risk factor*	PAC
Inpatient Medical ECR® (IM)	AMI	Typical risk factor*	PAC
	PNE	Typical risk factor*	PAC
	STR	Typical risk factor*	PAC
Outpatient Procedural ECR® (OPP)	PCI	Typical risk factor**	PAC
	GALL	Typical risk factor**	PAC
	HYST	Typical risk factor**	PAC
	KNRP	Typical risk factor**	PAC
	COLOS	Exclude trigger	PAC
	PREG	Typical risk factor**	PAC

*Please refer to Table 1 for full ECR® description

* Only ER from inpatient stay trigger claims is assigned as typical risk factor

** Only ER from inpatient stay trigger or outpatient facility trigger claims is assigned as typical risk factor

If the trigger code is present on an emergency room visit for any of the chronic medical ECRs® or for colonoscopy, the program looks for a more stable trigger claim before it triggers the ECR®.

For Hip Replacement, Knee Replacement and Bariatric Surgery, if the index trigger procedure stay was admitted through the ER, then the patient is excluded from the ECR®. For all others, the presence of an emergency room visit on the trigger claim is used as a risk factor in the severity adjustment models.

For most ECRs® (except CAD and GERD), an ER visit during the look-forward episode period is considered as a PAC.

2.1.3 Trigger Exclusion

For all ECRs®, the valid trigger claims cannot contain any trigger exclusion codes listed in the “trig_excl” fields (if applicable) of the “triggers” tab of the ECR® All_codes workbook. For all chronic medical ECRs® and colonoscopy, the trigger cannot be an emergency room service.

For each patient, the earliest claims during the study period that meet the trigger criteria and do not meet the trigger exclusion criteria are defined as the trigger claims.

2.1.4 Defining the Episode Time Window

For each ECR®, the episode time window is pre-defined and given in table 4 below:

Table 4: ECRs® Time Window			
ECR® Category	ECR® Name	ECR® Look-back period	ECR® Look-forward period
Chronic Medical ECR® (CH)	ASTHMA	0-days	One-year from trigger claim
	COPD		
	CHF		
	CAD		
	DM		
	HTN		
	GERD		
Inpatient Procedural ECR® (IPP)	HIPR	30-days prior to index admit date	180-days post-discharge after index stay
	KNEE		
	CABG		
	BARI		
	COLON		
Inpatient Medical ECR® (IM)	AMI	0-days	30-days post-discharge after index stay
	PNE		
	STR		
Outpatient Procedural ECR® (OPP)	PCI	60-day prior to index procedure	180-days post-discharge after index procedure
	GALL		
	HYST		
	KNRP		
	COLOS	7-days	30-day
	PREG	First definitive diagnosis of pregnancy "OR" 9 months (36 wks) prior to admit date for delivery	2 months (8 wks) after discharge from delivery

2.1.5 Episode Exclusion

Once the trigger is identified and the ECR® time period (from the start of look-back period to the end of follow up period) is established, patients meeting any of following exclusion criteria are terminated from the episode.

- (1) had an in-hospital death (discharge_status_code = '20', '40', '41', or '42') during the episode period;
- (2) left against medical advice (LAMA) (discharge_status_code = '07') during the episode period;
- (3) age at start of the trigger claim is less than the minimum age (default=2 for asthma, =10 for pregnancy and delivery, =18 for all other ECRs®) or equal to/greater than the maximum age (default=65) . Users are allowed to change the minimum and maximum age;
- (4) (*For KNEE, HIPR, and BARI only*) had the trigger claims admitted through the emergency room. Please note KNEE stands for Knee Replacement using the naming convention in table 1 and not Knee Arthroscopy.
- (5) (*For KNEE, HIPR, and KNRP only*) had bilateral or multiple procedures.

For KNEE, HIPR, and KNRP, we look for procedure functional/initial modifiers on the CPT codes and terminate episodes with bilateral (modifier 50) or multiple procedures (modifier 51) on the trigger claim. Also, for KNEE and HIPR, if the trigger claim contains repeat procedures (modifiers 76, 77) or removal of prostheses codes (80.05 for HIPR and 80.06 for KNEE), the episode is terminated.

For KNEE, HIPR, and KNRP, if a patient had more than one claim meeting trigger criteria during the episode period, the episode is terminated for that patient.

2.2 Checking Continuous Enrollment

For patients retained with valid triggers, continuous enrollment eligibility is checked for the episode period. If a patient has any enrollment gap during an inpatient medical ECR® or for colonoscopy episode, or a gap of >30 days during the other ECR® episodes, the episode is terminated for that patient. User can define a different allowable gap length.

2.3 Extracting All Medical and Pharmacy Claims for Each Episode

For patients who meet all trigger and enrollment criteria, we extract their claims to be used in further steps. The extracted claims include:

- 1) All inpatient stay claims during the episode period;
- 2) All outpatient facility, professional and other ancillary claims during the episode period;
- 3) All pharmacy claims during the episode period.

If the prescription fill date or the prescription fill date plus supply days fell within the episode window, we include that pharmacy claim in the ECR®. For example, if the prescription fill date is Jan 3rd 2009 and the supply days are 30 days, then the drug is valid for Jan 3rd 2009 till Feb 2nd 2009. If this prescription period overlaps with any part of the episode window, we include the pharmacy claim into the ECR®.

2.4 Subtraction Logic

During data construction for each ECR®, the codes present in the expanded trigger (Expnd_trgs) tab of the All_codes workbooks are removed (subtracted) from the CCS categories and treated individually. The rules, logic, and assignments for the codes in the Expanded Trigger worksheet for each ECR® supersede the CCS medical or procedural code assignments.

2.5 Excluding Irrelevant Patients (Cases)

We exclude a “patient” (terminate the episode) if the patient meets any of the following criteria:

- 1) Has any claim with a diagnosis code, CPT code or procedure code marked as “Termination” in the “Expnd_trgs” (expanded trigger) tab of the All_codes file for that ECR®;
- 2) Has any claim with a CCS diagnosis category marked as “irrelevant cases” in the “Medical” tab of the All_codes file for that ECR®;
- 3) Has any inpatient stay claim with a UB revenue code marked as “irrelevant cases” in the “Revenue_code” tab of the all code file.

Please note that due to the subtraction logic explained in Step 2.4, if a diagnosis or procedure code had been included in the “Expnd_trgs” tab, this code is not used to define irrelevant cases even if its CCS category is marked as “irrelevant_cases”.

2.6 Excluding Irrelevant Claims

We exclude “claims” that meet any of the following criteria:

- 1) Contain a CCS diagnosis category marked as “irrelevant_claims” in the “Medical” tab of the All_codes file;
- 2) Contain a CCS procedure category marked as “irrelevant_claims” in the “Procedure” tab of the All_codes file;
- 3) Pharmacy claims that have an NDC code that map to a Prometheus drug category marked as “delete”.

Please note that due to the subtraction logic explained in Step 2.4, if a diagnosis or procedure code had been included in the “Expnd_trgs” tab, this code is not used to define irrelevant claims even if its CCS category is marked as “irrelevant_claims”.

After irrelevant claim exclusions, all remaining claims are retained as “relevant” claims for the rest of the ECR® steps.

2.7 Defining Readmissions/Associated Admissions (*for IPP, IM, and OPP only*)

For IPP and IM ECRs®, all relevant inpatient admissions during the ECR® time window, other than the index trigger admission are defined as readmissions. For OPP ECRs®, all relevant

inpatient or outpatient facility admissions occurring before or after the index trigger admission are defined as associated admissions.

For each ECR®, the logic defining if readmissions / associated-admissions are classified as typical or PACs is given in Table 5.

Table 5: Defining Readmissions/Associated Admissions as Typical or PAC				
ECR® Category	ECR®*	Typical IP stay readmission/ associated admission	Typical OP facility associated admission	PAC (IP or OP) readmission/ associated admission
Chronic* Medical ECR® (CH)	ASTHMA	NA	NA	NA
	COPD	NA	NA	NA
	CHF	NA	NA	NA
	CAD	NA	NA	NA
	DM	NA	NA	NA
	HTN	NA	NA	NA
	GERD	NA	NA	NA
Inpatient Procedural ECR® (IPP)	HIPR	Typical bucket	NA	PAC bucket
	KNEE	Typical bucket	NA	PAC bucket
	CABG	PAC bucket	NA	PAC bucket
	BARI	PAC bucket	NA	PAC bucket
	COLON	Typical bucket	NA	PAC bucket
Inpatient Medical ECR® (IM)	AMI	PAC bucket	NA	PAC bucket
	PNE	PAC bucket	NA	PAC bucket
	STR	Typical bucket	NA	PAC bucket
Outpatient Procedural ECR® (OPP)	PCI	PAC bucket	Typical bucket	PAC bucket
	GALL	Typical bucket	Typical bucket	PAC bucket
	HYST	Typical bucket	Typical bucket	PAC bucket
	KNRP	PAC bucket	Typical bucket	PAC bucket
	COLOS	PAC bucket	Typical bucket	PAC bucket
	PREG	Typical bucket	Typical bucket	PAC bucket

*For chronic ECRs, all admissions are classified as PACs except for CAD and GERD when they are classified based on the codes on the stays.

*Please refer to Table 1 for full ECR® description

Not all readmissions are PACs e.g. readmissions for rehabilitation after joint surgery or stroke are classically considered as part of typical care. Readmissions and associated admissions could be typical or PAC depending on the codes present on the claims.

However, typical inpatient readmissions could still be potentially avoidable and counted as PACs based on the ECR® they belong to and according to the logic in the table above. This accounts for the clinical and coding logic differences that are difficult to program differentially. For example, a claim for AMI within a CABG ECR® is clinically considered as part of typical care when it is in the pre-op setting (and is used as a risk-factor for severity adjustment) but it is considered as a PAC in the post-op setting. From the coding stand-point it is therefore defined as typical but the typical readmissions for AMI in the post-op setting are further corrected and classified as PACS.

A word of caution: All admissions other than the index stay are treated as re-admissions / associated admissions. This may cause some of the pre-op admissions to be classified as PACs. While we understand that clinically this may not be defensible, this is an issue with programming the data and we plan to fix this in the next version of the ECRs. For now, we would alert the user, that such cases even though few with a minor impact on the total PAC dollars, may not be bucketed correctly. It is also important to understand that this is an issue only in the analytic phase of our program, not in the implementation, since the Engine will exclude these pre-op admissions.

2.8 Identifying PAC (Potentially Avoidable Complication) Claims

A relevant claim is defined as a PAC (potentially avoidable complication) claim if it meets any of the following criteria:

- 1) Contains a diagnosis or procedure code with an assignment of “PAC” or “HAC” in the “Expnd_Trgs” tab;
- 2) Maps to a CCS Diagnosis category marked as “PAC” in the “Medical” tab;
- 3) Maps to a CCS Procedure category marked as “PAC” in the “Procedure” tab;
- 4) (*For IPP and OPP ECRs® only*) The trigger claim contains CPT functional/initial modifier 78 (unplanned return to operating room);
- 5) (*For COPD, CHF, DM, HTN, and ASTHMA only*) All relevant inpatient stay claims;
- 6) (*For all ECRs® except for CAD and GERD*) All emergency room service relevant claims that occur after the trigger claims;
- 7) (*For IPP and IM ECRs® only*) If the index trigger is a PAC, all readmission claims are PAC;
- 8) (*For CH, IPP, IM ECRs® only*) All outpatient facility/professional claims within ± 2 days of a PAC inpatient stay period are PACs;
- 9) (*For OPP ECRs® only*) All professional claims within ± 2 days of a PAC inpatient stay or a PAC outpatient facility period are PACs.

All relevant claims that are not classified as PAC claims are defined as typical claims.

2.9 Selecting Typical Claims Using Expanded Triggers (the filter logic)

If a typical claim does not contain any diagnosis or procedural codes that are marked as typical or PACs in the “Expnd_Trgs” tab, this claim is excluded. This would ensure that only claims related to services for the ECR® of interest are retained. For example, an office visit would classically be a relevant claim for an ECR®. However, if the claim for the office visit does not contain any typical or PAC codes given in the expanded trigger tab for the given ECR®, then the claim is considered irrelevant to the ECR® and is filtered out.

2.10 Creating Medical Claims Buckets

Claims bucket files are created for each ECR® to include all relevant medical claims retained and to flag each claim with typical/PAC assignment as well as the reason for the assignment.

For IPP, and IM ECRs®, orphan episodes are identified as those that only have inpatient stay claims but no outpatient facility/professional claims or vice versa. For OPP ECRs®, orphan episodes are identified as those that have one of the following scenarios: 1) have only inpatient stay claims but no professional claims, 2) have only outpatient facility claims but no professional claims or 3) have only professional claims but no inpatient stay or outpatient facility claims. We delete patients with orphan episodes from the bucket files.

2.11 Creating Pharmacy Claims Buckets

Pharmacy claims bucket are created for each ECR® to include all relevant pharmacy claims and to flag each claim with typical/PAC assignment based on Prometheus drug ID.

2.12 Aggregating Allowed Amount at Episode Level

For each patient retained in the ECR®, the allowed amount values from each relevant claim are aggregated to the episode/patient level. The aggregated allowed amount is also broken down by claim type (inpatient stay/outpatient facility/professional/pharmacy), bucket type (typical/PAC), and event type (index/readmission/associated admission, for IPP, IM, OPP ECRs®).

If the aggregated allowed amounts for an episode are outside the following ranges, the episode is deleted.

All medical relevant episode allowed amount: \$20-\$1,000,000;

All relevant pharmacy episode allowed amount: \$1-\$1,000,000.

Users are allowed to change the values for the above ranges.

2.13 Creating Data Flow Report

A data flow report is produced to summarize the changes in claims and patient volumes at each major data filtering step. It shows how patients with trigger claims are filtered through enrollment, eligibility, and exclusion criteria to generate the final ECR® datasets with relevant claims. Number of unique patients and corresponding claim volumes, total/average allowed amounts, standard deviations, and allowed amount distribution at each major filtering step are included. The final rows of the report describe the summary counts and associated costs for all relevant episodes, as well as details by claim type (inpatient stay/ outpatient facility/ professional/ pharmacy), bucket type (typical/PAC), and event type (index/ readmission/ associated admission, for IPP, IM, OPP ECRs®).

The proportion of total relevant dollars spent for care of PACs in that ECR® is calculated and given at the end of the report as the “PAC rate”.

2.14 Assigning Typical Risk Factors

For each patient, typical risk factors are assigned to the patient if the patient’s typical claims contain codes from the following categories:

- 1) Medical or procedural codes defined as typical RFs in the “Expnd_Trgrs” tab;
- 2) Medical CCS categories defined as typical RFs in the “Medical” tab;
- 3) Procedural CCS categories defined as typical RFs in the “Procedural” tab;
- 4) Revenue codes from the inpatient stay claims defined as typical RFs in the “Revenue_code” tab;
- 5) *(For all IPP, IM and OPP ECRs® except for KNEE, HIPR, BARI and COLOS)* Emergency room service from typical facility index trigger claims is defined as a typical risk factor.

Please note that due to the subtraction logic explained in Step 2.4, if a diagnosis or procedure code had been included in the “Expnd_trgs” tab, the assignment logic (typical / PAC / exclude) follows the classification rules given in the “Expnd_trgs” tab of the All_Codes workbook for that given ECR®.

2.15 Creating Typical Episode Datasets and Frequency Reports

Typical episode datasets are created for each ECR® and each claim type. Types of typical dataset by ECR® categories are listed in table 6. These typical datasets are used to build the typical ECR® models (see Section III).

ECR® Category	Type of Dataset
Chronic Medical ECR® (CH)	Typical outpatient facility/professional/pharmacy dataset
Inpatient Procedural ECR® (IPP)	1. Typical inpatient index dataset 2. Typical outpatient facility/professional/pharmacy dataset
Inpatient Medical ECR® (IM)	1. Typical inpatient index dataset 2. Typical outpatient facility/professional/pharmacy dataset
Outpatient Procedural ECR® (OPP)	1. Typical inpatient index dataset 2. Typical outpatient facility index dataset 3. Typical professional/pharmacy dataset

Each dataset is created at the patient level, and contains all typical risk factor flags and the total typical allowed amount from the corresponding claim type.

Each dataset includes only patients whose total typical allowed amount from the corresponding claim types is greater than 0. For IPP and IM ECRs®, the typical outpatient facility/professional/ pharmacy datasets restricts patients to those that have “typical” inpatient index stays. For OPP ECRs®, the typical professional/ pharmacy datasets also restricts patients to those that have either “typical” inpatient index stays or “typical” outpatient facility index claims.

For each typical dataset, typical risk factor frequencies are reported as number and percentage of patients flagged with each typical risk factor.

2.16 Assigning PAC Labels

For each patient, PAC labels are assigned to the patient PAC claims if the claims contain codes from the following categories

- 1) Medical or procedural codes given a PAC # in the “Expnd_Trgs” tab.
- 2) Medical condition CCS categories given a PAC # in the “Medical” tab.
- 3) Procedural CCS categories given a PAC # in the “Procedural” tab.
- 4) (*For all ECRs® except for CAD and GERD*) Emergency room service that occurred after the trigger claims are also defined as PACs.

Please note that due to the subtraction logic explained in Step 2.4, if a diagnosis or procedure code had been included in the “Expnd_trgs” tab, the assignment logic (typical / PAC/ exclude) follows the classification rules given in the “Expnd_trgs” tab.

2.17 Creating PAC Reports

PAC reports are created for each ECR® and claim type. PACs are classified into three types: PACs related to index conditions, PACs due to comorbid conditions, and PACs suggesting patient safety failure.

- 1) PAC professional report:
 - i. For CH, IPP, and IM ECRs®, this report shows the number of patients and the allowed amounts associated with each PAC in the PAC professional, outpatient facility, and other ancillary claims. The claims and associated allowed amounts could be counted multiple times if there was more than one PAC on the same claim.
 - ii. For OPP ECRs®, this report shows the number of patients and the allowed amounts associated with each PAC in the PAC professional claims. The claims and associated allowed amounts could be counted multiple times if there was more than one PAC on the same claim.
- 2) PAC inpatient stay report:
 - i. For COPD, CHF, DM, HTN and ASTHMA, the PAC inpatient stay report shows the principal diagnosis of inpatient PAC stay and associated number of patients and the allowed amounts. The patient stay counts are unique with no double-counting.
 - ii. For CAD and GERD, PAC inpatient stay report shows the number of patients and the allowed amount associated with each PAC in the PAC inpatient stay claims. The claims and associated allowed amounts could be counted multiple times if there was more than one PAC on the same claim.
 - iii. For IPP, IM, and OPP ECRs®, PAC index inpatient stay report shows the number of patients and the allowed amounts associated with each PAC in the index trigger PAC inpatient stay claims. The claims and associated

allowed amounts could be counted multiple times if there was more than one PAC on the same claim.

3) PAC outpatient facility report:

- i. For OPP ECRs®, the PAC index outpatient facility report shows the number of patients and the allowed amounts associated with each PAC in the index trigger PAC outpatient facility claims. The claims and associated allowed amounts could be counted multiple times if there was more than one PAC on the same claim.

2.18 Creating Readmission/Associated Admission Reports

Readmission/associated admission reports are created for acute medical, inpatient procedural and outpatient procedural ECRs®.

1) IPP and IM ECRs®:

- a. Typical stay readmission report shows the principal diagnosis of typical stay readmission claims, the associated number of patients and the corresponding allowed amounts.
- b. PAC stay readmission report shows the number of patients and the allowed amounts associated with each PAC in the PAC inpatient readmission claims. The claims and associated allowed amounts could be counted multiple times if there are more than one PAC factors on the same claim. For PAC readmissions that do not contain PAC codes, principal diagnosis codes are listed to mark the reason for the readmission.

2) OPP ECRs®:

- a. Typical stay associated-admission report shows the principal diagnosis of typical stay associated-admission claims, the number of patients and their allowed amounts.
- b. Typical outpatient facility associated-admission report shows the principal diagnosis of typical facility associated-admission claims, the number of patients and their allowed amounts.
- c. PAC stay associated-admission report shows the number of patients and their allowed amounts for each PAC in the PAC inpatient associated-admission claims. The claims and associated allowed amounts could be counted multiple times if there is more than one PAC on the same claim. For PAC stay associated admissions that do not contain PAC codes, principal diagnosis codes are listed to mark the reason for the admission.
- d. PAC outpatient facility associated-admission report shows the number of patients and their allowed amounts for each PAC factor in the PAC outpatient facility associated-admission claims. The claims and associated allowed amounts could be counted multiple times if there are more than one PAC factors on the same claim.

3 Model Construction

The typical datasets created in Section II Step 15 (2.15 above) are used to build typical risk-adjustment models for each ECR® and each claim type. Patient demographic factors as well as the typical risk factors, flagged in each typical dataset, are included as potential predictors of typical allowed amounts for model selection. A risk-adjusted predicted allowed amount is calculated for each patient using the final best fit model. If a dataset fails to build a risk-adjustment model, the average typical allowed amount (among trimmed data) is used as the predicted allowed amount for all patients with that ECR® and claim type.

3.1 Statistical Analysis Methods

The constructed model described in this section captures the specific characteristics of the clients' own data, uncovering significant predictors of cost and calibrating the model to the client's data set. Some of statistical methodology differs slightly by ECR®. These differences are described in 3.1.2 ECR-specific Modifications to Statistical Methodology below.

3.1.1 Algorithm of Modeling

The following is an algorithm that results in a predictive model containing significant positive predictors and satisfying ordinary least-square (OLS) assumptions. The model-building principles used in this algorithm are the same principles that statisticians use when constructing models. Some correlation between model variables or heteroscedasticity (non-constant prediction error) may still exist and can be addressed after this automated step is performed. The algorithm assumes data checks have been performed and that data has been screened for entry errors or other inconsistencies. All analyses are performed on the full dataset, after any possible trimming or data exclusions.

- 1) **Transformation of dependent variable and Trimming:** The assumptions used in OLS regression state that the model residuals (difference between actual and predicted values) must be Normal in distribution with constant variance. Cost data is usually skewed, and the model residuals often violate this assumption. Taking the natural log of cost often solves this dilemma. It is assumed that most of the time, this is the case, hence LN(ALLOW) is the dependent variable for the Prometheus cost models. Even with the log transformation, unusually high or low costs can cause the model to predict poorly, so it is common practice to "trim" the data by removing a small percentage of very high and low costs. Our algorithm removes costs below the 1st percentile and above the 99th percentile of cost distribution.
- 2) **Univariate screening:** To determine which variables should be candidates for model development, all variables are first screened for univariate significance in predicting transformed cost. The only continuous variable is AGE. To screen dichotomous variables, univariate t-tests are performed and variables having a p-value greater than 0.25 are eliminated. Any variable occurring in less than 1% of patients or more than 90% of patients are also eliminated.
- 3) **Stepwise Selection of variables.** Once the univariate tests have been performed and used to screen out insignificant variables, or variables which occur infrequently or too frequently, the remaining pool of candidate variables are entered into a stepwise least-squares model of (log) allowed cost. Default values of 0.05 are used to control which

variables enter and remain in the model. Stepwise selection often uncovers an abundance of predictive variables, however the resulting model can often be un-parsimonious and have several correlated predictors. The next step removes correlated variables and drops variables that may be significant, yet contribute very little to the overall predictiveness of the model.

- 4) **Model Cleanup:** It is desirable to have model variables that are not highly correlated with each other, generally with positive coefficients, and each variable contributing to the fit of the model in a non-trivial amount. The Variance Inflation Factor (VIF) is one way to detect correlation among model variables. Correlated variables often have negative coefficients as well. The first task in cleaning up the resulting model is to remove variables with negative coefficients. Variables having negative coefficients are eliminated one at a time, in order of increasing partial r-squared value. Each time a variable is removed, the model is re-run and the coefficients are re-evaluated. Once the algorithm has removed all of the variables having negative coefficients, the algorithm proceeds to eliminate variables having a high VIF, in order of decreasing VIF. This step proceeds in the same way, removing one variable at a time, then re-running the model and re-evaluating the coefficients. After removing these variables, the algorithm looks for any variables that have a small partial r-squared value (below 0.001), and eliminates these variables all at once.
- 5) **Initial Model:** The model resulting from steps 1-3 above is considered the initial model. It is also desired to produce a robust model that would generalize well to new data sets, that is, it is not over-fitted. To avoid over-fitting, the model is then validated using a bootstrapping algorithm as described in the next step.
- 6) **Bootstrap Validation:** The above model is run using stepwise selection with SLE (significance level for model entry) = 0.05 and SLS (significance level for staying in model) = 0.05 on 200 bootstrap samples, and a record is kept of how many times each variable is selected with a positive coefficient in the 200 model runs. A bootstrap sample is created as follows: sample with replacement from the full dataset until a sample of the same size as the full dataset is drawn. It can be shown that on average, $1/e$, or 36% of the observations in each bootstrap sample are repeats of other observations in the sample. Thus each bootstrap sample is designed to emulate a new data set with different distributions of its elements.
- 7) **Final Model:** Variables which do not consistently perform as significant predictors in at least 75% of the 200 bootstrap validations are dropped. The final step is to run the model cleanup algorithm as in Step 4 one last time. The reason for doing this is that removal of some variables may cause perturbations in the sign of other variables, if there exists some correlation between these variables. The resulting model is the final model.
- 8) **Retransformation Bias:** Because cost is log-transformed before it is modeled, there is a bias that occurs when one tries to back-transform predicted LN(ALLOW) into the original units. This results in systematic underpayment and the cumulative effect can be substantial. For this reason a Bias Correction Factor (BCF) is calculated as the ratio of the total actual costs in dollars (of all patients that went into the model) to their predicted costs. Multiplying the predicted cost by this BCF assures that there will be no systematic under or over-prediction of cost on the user's data set.

3.1.2 ECR-specific Modifications to Statistical Methodology

For some ECRs®, the statistical methodology described above was modified slightly.

Asthma – Two separate typical models were developed, one for members aged 2 – 17 years and another for members 18 and older. The reason two models were needed is that the predictors of costs for these two age groups may be different. Each model was developed using the algorithm described in 1.1 above.

Coronary Artery Disease (CAD) and Gastro-esophageal Reflux Disease (GERD) – Unlike other chronic medical ECRs®, where all hospitalizations were considered potentially avoidable (PACs), some hospitalizations for CAD and GERD were considered “typical”. These hospitalizations became part of the typical episode and were included in the model building for risk-adjustment. This led to a single typical model that contained professional and pharmacy services as well as some services in the hospital setting.

Inpatient Procedural ECRs® & Acute Medical ECRs® – Two separate typical models were developed, one for inpatient stay costs and another for outpatient facility, professional, pharmacy, and all other costs combined. The reason two models were needed was that the predictors of costs for the index inpatient facility services come bundled and may be different than the professional and other services that come individually during the episode time window, and consequently, their models may be different. Each model was developed using the algorithm described in 3.1.1 above.

Outpatient Procedural ECRs® – If there was significant volume of cases for each component, three separate typical models were developed, one for inpatient stay costs, one for outpatient facility, and one for professional, pharmacy, and all other costs combined. The reason three models were needed was that for outpatient procedural ECRs, there could be an index outpatient procedural event or an index inpatient procedural event that is the main driver of costs, and predictors of costs for these types of services may be bundled and different, and consequently, their models may be different. Each model was developed using the algorithm described in 3.1.1 above.

Prometheus used the above methods to develop standard regression models for each ECR® using a commercially insured population from the developmental database. This method has also been included as automated programs in the Prometheus ECR® package to build user data-specific models.

3.2 Benchmark (Reference) Database: Commercially Insured Population (CIP)

Our benchmark developmental database is a two-year national database of 4.7 million covered lives and over 95 million dollars in allowed amounts. It is called the CIP (commercially insured population) database and is used to create the reference PAC rates as well as benchmark “predictor list” (used in the scoring 2 program below) as well as the coefficients for the risk-adjustment models (used in the scoring 1 program given below).

Below is the logic used by the programs to determine which scoring logic will give the best fit model for a given ECR® in the user's own database.

3.3 ECR® Risk-adjustment Model

Separate risk-adjustment models are created for each of the components of the episode (stay, outpatient facility, and professional & pharmacy) where applicable. Chronic care ECR®s have only one risk-adjustment model (PFO: professional, pharmacy and other claims model); inpatient procedural (IPP) and inpatient medical (IM) ECR®s, each potentially have a stay model and a PFO model; and outpatient procedural (OPP) ECR®s each potentially have three models (inpatient stay, outpatient facility and PFO models). While the ECR® dataset always includes patients of all ages, the risk-adjustment models are constructed only using patients within the study age range and therefore the results are valid only for the study age range. Depending on the sample size and the availability of the corresponding standard CIP models, the modeling program automatically chooses one procedure from the following 4 options to create each of the risk-adjustment ECR® models:

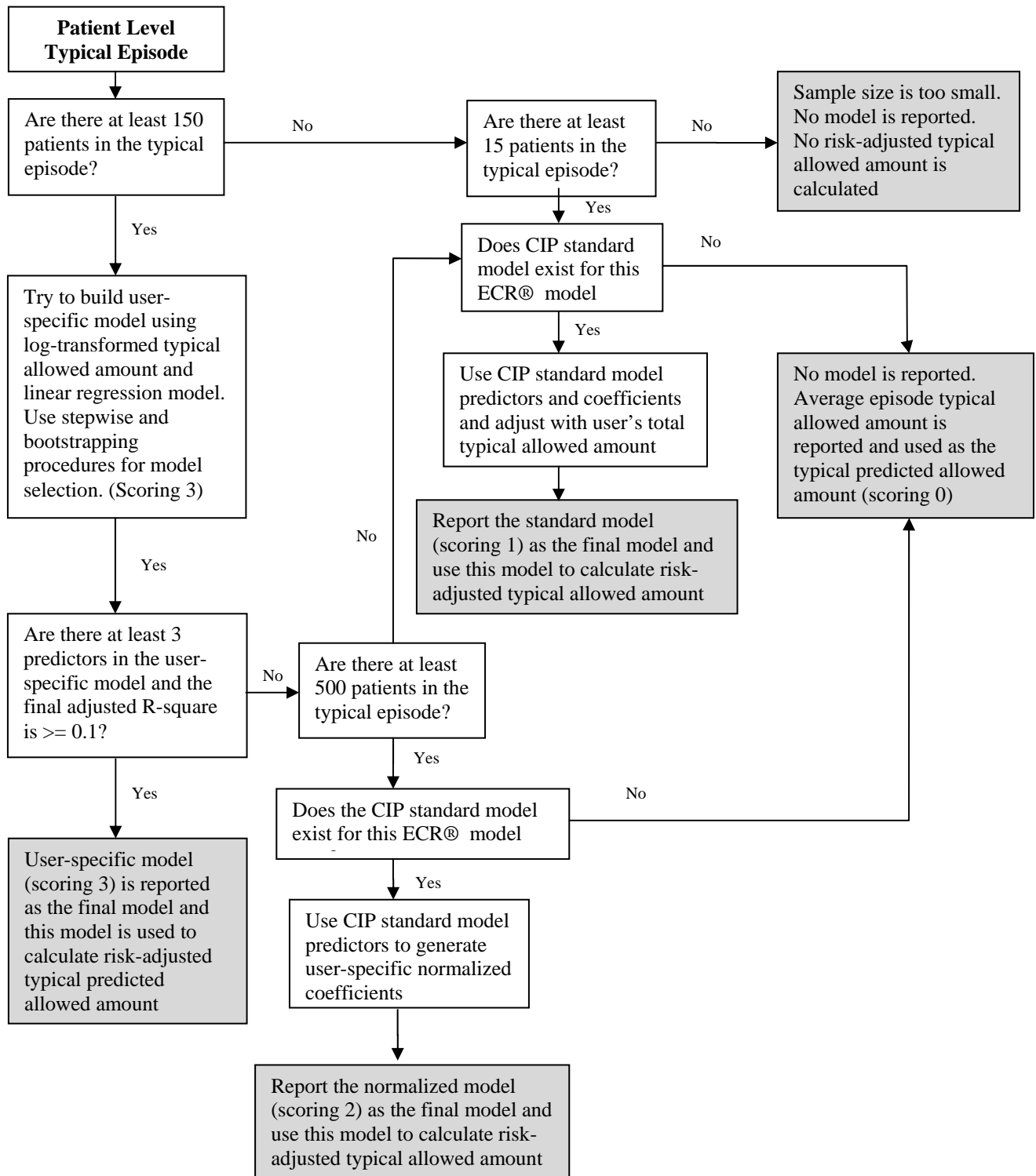
1. Scoring 3: Builds a user-specific model based on the user's own fee schedules and practice patterns, selects predictor variables that are specific to the user's database, and calculates the risk-adjusted typical predicted allowed amount. The statistical processes applied behind the scenes include stepwise linear regression analysis using log-transformed typical allowed amount as dependent variable and typical risk factor flags as the predictors and 200 runs of bootstrap processes for model selection and validation (see 3.1.1 above). This logic is used when the user's sample size is at least 150. If the final model generated through this procedure contains at least 3 predictors and the adjusted R-square is at least 0.1, then the user-specific model is reported as the final model. Otherwise, one of the Scoring 0, 1, or 2 logics is used to select the final model depending on the sample size and the availability of the CIP standard models.
2. Scoring 2: Uses the standard CIP model "predictor" list but generates normalized coefficients based on user-specific fee schedules and practice patterns. This model is used to calculate the risk-adjusted typical predicted allowed amounts in the user's data. This logic is used when the sample size is at least 500 and the user's data has failed to build a user-specific model.
3. Scoring 1: Uses the standard CIP model "predictors" as well as "coefficients" to calculate the risk-adjusted typical predicted allowed amounts in the user's data. The model intercept is adjusted using a bias correction factor to make the total predicted typical allowed amount equal to the total actual typical amount in the user's database (after trimming for outliers). This logic is used when the user's sample size is between 15 and 150 and there is a CIP standard model available, or the user's sample size is between 150 and 500 but the user's data has failed to build a user-specific model.

4. Scoring 0: Reports user's average allowed amount using typical allowed amount values trimmed at 1st and 99th percentile values for costs. This logic is used when there is no existing standard CIP model; and the user's sample size is between 15 and 150, or the user's sample size ≥ 150 but the data has failed to build a user-specific model.

If the sample size is less than 15, no model or average allowed amount is reported. No risk-adjusted allowed amount is calculated. The summary of the above logic is outlined in Figure 1. Availability of the CIP models is summarized in table 7.

ECR® Category	ECR® Name	Model Availability		
		STAY	FACI	PROF
Chronic Medical ECR® (CH)	ASTHMA			Yes
	COPD			Yes
	CHF			Yes
	CAD			Yes
	DM			Yes
	HTN			Yes
	GERD			Yes
Inpatient Procedural ECR® (IPP)	HIPR	No		Yes
	KNEE	No		Yes
	CABG	Yes		Yes
	BARI	No		Yes
	COLON	No		Yes
Inpatient Medical ECR® (IM)	AMI	Yes		Yes
	PNE	Yes		Yes
	STR	Yes		Yes
Outpatient Procedural ECR® (OPP)	PCI	Yes	Yes	Yes
	GALL	Yes	No	Yes
	HYST	No	Yes	Yes
	KNRP	No	Yes	Yes
	COLOS	No	Yes	Yes
	PREG	No	No	Yes

Figure 1: Prometheus ECR® Modeling Sequence Logic



4 Full ECR® Price Calculation

The full ECR® price is the evidence informed case rate (ECR®) and is created as the sum of the following 5 portions:

- 1) Risk-adjusted predicted typical allowed amount
- 2) Adjustment for under-use of core services (for Chronic medical ECRs® only)
- 3) PAC Allowance:
 - a. Flat-rate PAC allowance
 - b. Risk-adjusted (proportional) PAC allowance
- 4) “Typical” readmission/associated admission allowance (for IPP and OPP ECR® that have readmissions / associated admissions classified as typical – see table 5)
- 5) Margin allowance

A full ECR® price is calculated at the patient level for patients included in each typical dataset. For CH ECRs®, a single full ECR price (outpatient facility/professional/pharmacy) calculation is calculated, whereas for IPP, IM, and OPP ECRs®, separate ECR price calculations are first done for each claim type (stay, professional and outpatient facility where applicable) and the full ECR price is then calculated as the sum of the price from each claim type for the patient.

The full ECR® price is calculated using the following steps (Step 1-5 are performed for each claim type separately):

4.1 Calculating Risk-adjustment Predicted Typical Allowed Amounts

This step is already described in Section III above.

4.2 Calculating Adjustment for Under-use of Core Services (*for CH ECRs® only*)

For each chronic care ECR®, we calculate the user-specific cost of core services. This is based on the average unit cost and the number of services recommended using evidence informed guidelines during the episode period for each ECR®. Gaps in care are calculated on a patient-by-patient basis and an allowance given upfront for the underuse.

Adjustment for under-use of core services at the ECR® level is calculated as the sum of gaps for individual patients included in the ECR®.

4.3 Calculating PAC Allowance

The PAC allowance is calculated as a proportion of the total PAC pool (Prometheus default = 50%) that is redistributed to providers irrespective of the occurrence of PACs but is in part based on the severity of the patients.

- 1) **Total PAC Pool Calculations:** The total PAC pool includes all the PAC dollars in a given ECR® and includes the following:
 - a. All the professional claims dollars that are classified as PACs
 - b. All the pharmacy claims dollars that are classified as PAC
 - c. All outpatient facility claims dollars for chronic care ECRs® that are classified as PACs
 - d. All inpatient stay claims dollars for chronic care ECRs® that are classified as PACs

- e. For IPP, IM and OPP ECRs®, if the index stay is a PAC, the entire claim dollars are not placed in the PAC pool but the added burden for PAC costs are calculated as the difference between an average PAC stay cost and an average typical stay costs. The total added burden for index PAC stays is calculated as follows:

$$(\text{Ave. PAC index cost} - \text{Ave. typical index cost}) \times \text{Number of PAC index patients}$$

This is calculated separately for inpatient index stays and outpatient facility index stays.

- f. For IPP, IM and OPP ECRs®, all the readmissions / associated admissions claims dollars that are classified as PACs
- g. For chronic care ECRs®, the care coordination (underuse) amount is subtracted from the PAC pool before the PAC allowance is calculated. This care-coordination amount is given to each patient based on gaps in the care-coordination dollars as shown in step 2 above. Because the total **adjustment for under-use of core services** is deducted from the PAC pool, it is possible that all the PAC dollars are used in paying for care coordination/under-use and no dollars are left behind in the PAC pool. In this case, no further PAC Allowance is given.

2) PAC Allowance Calculation:

Fifty percent of the PAC dollars from the total PAC pool are re-distributed to each patient irrespective of the occurrence of PACs and is called the PAC allowance.

- a. **Flat-rate PAC allowance:** 25% of the PAC allowance dollars are distributed equally to all patients with relevant episode costs.
- b. **Risk-adjusted (proportional) PAC allowance:** 75% of the PAC allowance dollars are made available to all patients with relevant episode costs based on the severity of the patients. Patient-level proportional PAC allowance is calculated by multiplying their risk-adjusted predicted costs with a common proportional factor.

The proportional factor is calculated by dividing the proportional dollar pool amongst all patients if they had typical costs. The formula is given below:

$$75\% \text{ of the PAC allowance dollars } / [\text{average cost of typical care} * \text{number of relevant patients}]$$

4.4 Calculating Typical Readmission Allowance

(For IP stay and OP facility components of the ECR® only) Typical readmission or associated admission amount is calculated as the average typical readmission/associated admission amount for the typical index patients.

4.5 Calculating Margin Allowance

In the current Prometheus model, we have set the margin at 0%. However, a 10% margin (or any other number that the user considers best) could be added towards the full ECR® price.

4.6 Calculating Full ECR® Price

Patient-level full ECR® price is calculated as given in table 8 below:

Table 8. Full ECR® Calculation Method			
ECR® Category	Type of Claim	ECR® Price by Type of Claim	Full ECR® Price
Chronic Medical ECR® (CH)	outpatient facility/ professional/pharmacy	Risk-adjusted predicted typical allowed amount + core service gap adjustment + flat-rate PAC allowance + proportional PAC allowance +margin	Outpatient facility/ Professional/ pharmacy ECR price
Inpatient Procedural ECR® (IPP) <i>or</i> Inpatient Medical ECR® (IM)	Inpatient	Risk-adjusted predicted typical allowed amount+ flat-rate PAC allowance + proportional PAC allowance +typical readmission allowance + margin	Inpatient ECR price + Outpatient facility/Professional/p harmacy ECR price
	Outpatient facility/ professional/pharmacy	Risk-adjusted predicted typical allowed amount+ flat-rate PAC allowance + proportional PAC allowance +margin	
Outpatient Procedural ECR® (OPP)	Inpatient	Risk-adjusted predicted typical allowed amount+ flat-rate PAC allowance + proportional PAC allowance +typical associated admission allowance + margin	Inpatient ECR price + Professional/ pharmacy ECR price OR Outpatient facility ECR price + Professional/ pharmacy ECR price
	Outpatient facility	Risk-adjusted predicted typical allowed amount+ flat-rate PAC allowance + proportional PAC allowance +typical associated admission allowance + margin	
	Professional/pharmacy	Risk-adjusted predicted typical allowed amount+ flat-rate PAC allowance + proportional PAC allowance +margin	

4.7 Severity Index

User's Severity Index: User's Severity Index helps determine if the user's population is sicker than the benchmark population in the developmental CIP (commercially insured population, section 4.1) database. A user-specific severity index is calculated for each ECR® using an indirect standardization technique. The procedure uses the standard CIP professional model coefficients as weights to score the severity of patients in the user's database. The ratio of user's average patient severity to CIP average patient severity for a given ECR is the user's severity index for that ECR.

Patient Severity Index: Patient Severity Index helps determine the relative severity of individual patients within the user's population for each ECR®. To calculate patient's severity index, the user-specific professional model coefficients are used as weights to score the severity of individual patients. The ratio of individual patient's severity to the average severity of all patients within the user's database for a given ECR is the patient's severity index.

5 Changes in V3.5.2 and Enhanced Analytic Capabilities

As we move from SAS version 3.5 to version 3.5.2., we anticipate there may be questions regarding what has been changed. This section illustrates the most important alterations in version 3.5.2.

5.1 Name Changes:

1. First and foremost, there has been an important name change: The name “Added Burden” has been changed to “Additional Facility Costs due to PACs”. This has been done to make it easier for users to understand that this represents the PAC portion of the index facility costs (inpatient or outpatient).

2. In addition some of the names for PACs and risk factors that were too long have been edited to make them more user-friendly and a few assignments have been changed for PAC designation:

- For PAC18 for chronics ECRs – the name has been changed from “Skin and wound care, traction, splints, osteomyelitis, infective arthritis” to “Cellulitis, Skin infections”
- For colonoscopy ECR, AMI PAC assignment has been changed from a 1 (PAC due to index condition) to a 2 (PAC due to comorbidity).
- For diabetes ECR, PAC assignment for “Cellulitis, Skin infections” has been changed from a 2 (PAC due to comorbidity) to a 1(PAC due to index condition).

5.2 Metadata Changes:

- In V3.5.2, a filter for ICD-9 procedure codes has been added that filters out invalid procedure codes.
- V3.5.1 already had the filter for ICD-9 diagnosis codes to filter out invalid diagnosis codes.

5.3 Excel Reports:

- In the Full_ECR_Summary, the PAC costs that are being reported now represent the total “true” PAC costs – this includes the PAC professional, PAC pharmacy, PAC hospitalizations (for chronic ECRs), PAC readmissions, PAC ER visits as well as the PAC portion of the index facility costs that we call “additional facility costs due to PACs” (for IM, IPP, and OPP ECRs). However this causes a discrepancy with the Data Flow tables where the PAC index facility costs report the full facility costs of stays that are labeled as PACs. The PAC% calculations at the bottom of the Data Flow table however reflect the corrected PAC costs and match the Full ECR Summary table outputs.
- In the Full_ECR_Summary a readmission allowance has been added to account for typical readmission costs.
- Provider-variation due to outliers has been eliminated – this will simplify the understanding and administration of the ECRs.

5.4 Patient Level intermediate SAS output files:

- The Patient level summary file and the patient level full ECR file now shows the “additional facility costs due to PACs”. In version 3.5, only “all PAC IP facility costs” or “all PAC OP facility costs” was presented in the patient level summary files. We have now separated out “additional facility costs due to PACs” to show the “true” PAC costs in index stays.

We attribute only that portion of the PAC index stay costs towards PAC dollars that is above the average typical index stay costs. However, if this difference is negative (i.e. the PAC index stay costs is less than a typical index stay), at the patient-level these negative costs are set at zero. These calculations could introduce a discrepancy if the total PAC costs due to index stays are summed across all patients. We recommend using the total PAC dollars from the Full_ECR_Summary file rather than summing up the patient-level PAC dollars.

- For each patient with typical index costs, the full ECR file with patient-level outputs now also contain:
 - i. a Count of all Risk Factors (excluding age and gender),
 - ii. the Severity Score (using the final scoring logic used by the algorithms),
 - iii. the Severity-Index (patient severity score divided by the average severity score for all patients in the database with the given ECR),
 - iv. the Total Actual PAC Costs (includes the PAC readmission or associated admission costs, PAC professional and PAC pharmacy costs),
 - v. the Severity-Adjusted Typical Costs (the total actual typical costs divided by the severity index from iii above),
 - vi. the Relevant Costs after Severity-Adjusting Typical Costs (Severity-Adjusted Typical Costs from v above plus the Total Actual PAC costs from iv above), and
 - vii. PAC% after Severity-Adjusting Typical Costs (Total Actual PAC costs from iv above divided by Relevant Costs after Severity-Adjusting Typical Costs from vi above).

5.5 RF SEVERITY ADJUSTMENT Module

A new module has been created in version 3.5.2 that aggregates the patient level risk factor counts to create various analyses at the level of risk factor cohorts. These advanced analytics allow users to look at average PAC costs, average severity-adjusted typical costs, average relevant costs (after severity-adjusting typical costs), and average PAC% (after severity-adjusting typical costs), by risk factor cohorts for each ECR. By looking at these patterns, users could determine how to make their data actionable. If high risk factor cohorts have higher PAC costs, these patients could be readily identified and could be targeted for disease management. However, if the trends are different, a provider-specific analysis may help identify practice patterns variations that are driving the variation in costs. This will give users a deeper understanding of their data and make it more actionable to improve cost efficiency and care quality.

For those who have run version 3.5 and do not want to run their data through version 3.5.2 again, we have created a separate, stand-alone module that can be used for severity score calculations and the risk factor aggregated analysis included in the new version.

5.6 Additional features and capabilities with the outputs

With appropriate data, the user can conduct additional analysis using the patient-level ECR® outputs. The following sections highlight a few analyses that the user may be interested in.

- **Provider level (Attribution) analysis**

The user can conduct provider level analysis, if a member-provider attribution logic has been developed.

- First, the user should attribute each member to the providers that hold responsibility for the member's episode.
- The user can then stratify the patients from the Summary file, by provider, and aggregate patients' ECR® information (such as relevant, typical, PAC allowed amount) for each provider to generate provider level data flow.
- Enhanced analytics as described in section 5.5 can be rolled up at the provider level to develop provider-level average severity index, provider-level average severity-adjusted typical costs and provider-level average PAC% after severity-adjusting typical costs.
- Similarly gaps in care for chronic ECRs® can be aggregated at the provider-level.

For users who do not have a member-provider attribution logic or wish to use the Prometheus default attribution logic or the various options within the Prometheus programs, a separate V3.5.2 A (attribution) module has been created to allow users to run these analyses with ease.

- **Regional variation analysis**

If the user has patients' residential data, such as zip code, a regional variation analysis could be conducted.

- The user can stratify the patients from the Summary file by zip code.
- The user can then aggregate patients' ECR® information (such as relevant, typical, PAC allowed amount) for each zip code to generate zip code level data flow.
- Similar regional analysis can be conducted at county level or state level, if data is available.
- Enhanced analytics as described in section 5.5 can be rolled up at the regional level to develop regional average severity index, average severity-adjusted typical costs and average PAC% after severity-adjusting typical costs.
- A regional variation analysis of care-coordination / underuse amount for chronic care ECRs® can also be done at the regional level to identify geographic regions with such gaps.

A separate module has been created called V3.5.2 R to allow the users to run these analyses with ease.

Part II ECR® Program Instruction

Healthcare claims data from any governmental or private dataset can be used. In order to construct the ECR®, the claims data must first be mapped to a standard format. This section contains instructions on how to calculate the ECR® budgets using healthcare claims data and SAS® Software¹ and explains the three steps needed to create an ECR®: (1) Data fields mapping, (2) ECR® dataset construction, and (3) ECR® modeling. This section further describes the outputs that are generated from the SAS programs such as the flow tables, the PAC rates, the full ECR® price, the severity index, as well as other applications that can be derived from these outputs such as regional variation analysis or provider-level analysis.

1 Initial SAS Settings

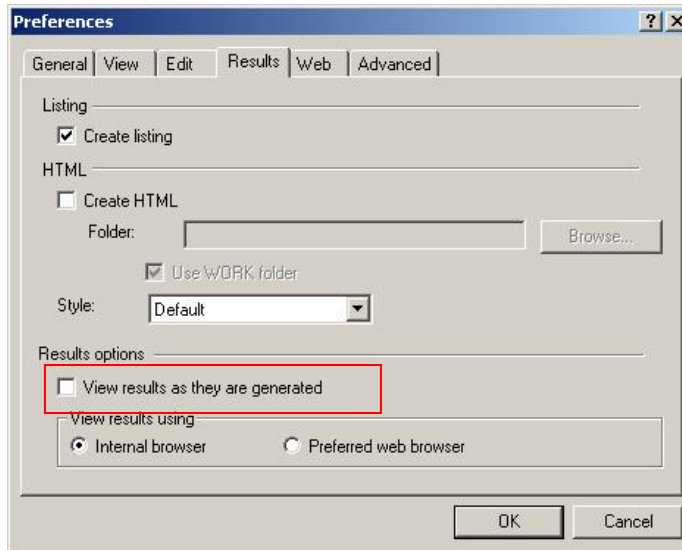
All SAS® programs were developed and tested using SAS® Version 9.1.3 on Windows XP. SAS® modules required to run the data handling portion of this package are the SAS® Base Product (which includes base and macro compilers) and SAS/ACCESS Interface to PC Files. The module SAS/STAT is required to run the ECR® models. You may verify your compliment of SAS® modules by running (i.e. submitting) the following code within the Program Editor and viewing its results in the log:

```
proc setinit;  
run;
```

Running SAS programs within this package will generate multiple Microsoft® Excel outputs. To prevent the SAS system from halting when it opens each one, and thereby either delaying running code or requiring a user to sit and wait in front of a computer, it is best to perform the following adjustment to the “View results” SAS system option before running any code.

1. From the “Tools” menu, select the “Options” and then “Preferences” option. The “Preferences” dialogue box will appear.
2. Click on the “Results” tab at the top.
3. Under the section titled “Results options,” make sure that the checkbox labeled “View results as they are generated” is **UNCHECKED**. See the following picture to help locate this option.

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4. Click the “OK” button to save the setting change. This option will have to be manually restored back to a checked option after the completion of running this package’s SAS code if the user wishes to restore this option for other applications.

Users running SAS® in UNIX or LINUX could request our separate UNIX SAS package.

This instruction book, as well as the SAS® programs, was prepared by the Massachusetts Peer Review Organization, Inc., better known as Masspro, Inc. (www.masspro.org), for Health Care Incentives Improvement Institute, Inc.

2 Input Data Field Mapping

2.1 Overview

2.1.1 Medical Coding Systems

The user-supplied healthcare claims data should use the following medical coding systems:

- 1) Diagnosis and procedure codes: International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM).
- 2) Procedure codes: Healthcare Common Procedure Coding System (HCPCS)/American Medical Association's Current Procedural Terminology (CPT®) codes.
- 3) Revenue codes: Uniform Billing (UB-04) revenue codes
- 4) Medications: National Drug Codes (NDC).

The supplied SAS programs convert ICD-9-CM diagnosis and procedure codes and HCPCS/CPT codes into Agency for Healthcare Research and Quality (AHRQ) Clinical Classification Software (CCS) codes. NDC codes are converted to Prometheus drug ID codes. Therefore, the user does not need to supply CCS or drug ID codes.

2.1.2 User provided Healthcare Data

The user will need to provide the following healthcare data. These datasets will be used as input datasets to the supplied SAS programs.

- 1) Member: contains member ID, year of birth, and gender.
- 2) Member Enrollment: contains enrollment beginning and ending dates for each member.
- 3) Inpatient Stay Claims: contains inpatient stay claims with service dates, diagnosis and procedure information, associated costs, and provider ID (optional).
- 4) Professional, Outpatient Facility, Ancillary and Other Claims (PFO): includes professional and outpatient facility claims with service dates, diagnosis and procedure information, associated costs, provider ID (optional), and provider specialty (optional).
- 5) Pharmacy Claims: includes all prescription claims with prescription date, NDC codes and associated costs.

2.1.3 Meta Data

Prometheus program provides to the users SAS metadata files that contain code definitions for each ECR®. Meta datasets include:

- 1) ICD-9-CM / CPT codes for defining triggers.
- 2) ICD-9-CM codes / CPT /revenue codes for defining expanded triggers and case exclusions, relevant claims, claims with potentially avoidable complications (PACs), and typical claims.
- 3) CCS codes for defining case exclusions, relevant claims, claims with potentially avoidable complications (PACs), and typical claims.
- 4) Prometheus drug ID for defining exclusions, PAC and typical prescriptions.
- 5) Risk factor definition codes.
- 6) CCS and ICD-9-CM / CPT codes crosswalk.
- 7) NDC and Prometheus drug ID crosswalk.

2.2 Data Cleaning and Reconciliation

All source data should be cleaned and reconciled before use.

General instruction:

- 1) Remove all duplicated records and invalid codes.
- 2) Medical claims should be divided into two files as follows:
 - i. The inpatient stay claim file should have just inpatient “facility” claims – anything that is identified as a 1 = Type of facility (Hospital) and 1 = Bill class (inpatient including Medicare part A) on a UB claim,
 - ii. All other claims should be in the PFO (Professional, Outpatient Facility, Ancillary and Other Claims) – these include inpatient professional claims, outpatient facility claims, post-acute facility claims and outpatient professional claims.

All claims that come on an inpatient UB form go into the inpatient stay file. Professional and pharmacy services that are provided during the hospital stay (e.g. services provided by anesthesiologists or radiologist as employees of the hospital), if billed along with the hospital bill, do not need to be separated out. If however, they are billed separately, say on a CMS / HCFA 1500 claim form, those bills go to the PFO file.

- 3) How to roll over the claims and reconcile the dollars
 - i. For inpatient facility bills – there should be one “final” bill per admission (discharge) – the interim bills should be reconciled and accounted for all negative dollars and adjustments. The data will look like the data in the following table:

Consistent_member_id	From_date_s	Thru_date_s	Principal_diag_code	secondary_diag1_code	principal_proc_code	Proc_icd9_2nd1	Allowed_amt	...
00001	02/03/2005	02/15/2005	41071	2875	3613	3961	103169.85	...
00002	05/01/2005	05/20/2005	65661	66712	6902	7359	11386.69	...
00003	08/12/2005	09/11/2005	41401	4111	0066	3606	39740.88	...

- ii. For outpatient facility/professional bills –leave claims at “claim-line” level but heavily populate them with all the diagnosis codes at the claim header level. The data will look like the data in the following table:

Consistent_member_id	From_date_s	Thru_date_s	Principal_diag_code	secondary_diag1_code	secondary_diag2_code	Hcpcs_proc_code	Allowed_amt	...
00001	07/09/2005	07/09/2005	61610	6259	7099	99213	85	...
00001	07/09/2005	07/09/2005	61610	6259	7099	87210	25	...
00002	07/11/2005	07/11/2005	7876	5693	V1859	36415	16.7	...
00002	07/11/2005	07/11/2005	7876	5693	V1859	80076	38.33	
00002	07/11/2005	07/11/2005	7876	5693	V1859	86706	65.9	

- 4) All supplemental adjustment claims should, where applicable, be reconciled with original claims that need to be adjusted so that there is only one finalized claim line (i.e. If a claim is adjusted later with an additional claim line, those two claim lines should be reconciled into one claim line).

- 5) Type of claim: Medical claims should be identified with a flag as follows:
1=inpatient facility, 2=outpatient facility, and 3=professional and ancillary
- 6) Place of service codes and Type of admission codes are needed ONLY to help identify emergency room services for both inpatient stay claims and the outpatient facility and professional claims.

Input file-specific instruction:

- 1) Member file should keep unique record for each member. If the member ID covers the whole family, assign a separate ID for each family member and apply the new ID across all files.
- 2) Member enrollment file should keep complete enrollment start and end date information for each member. If a member has more than one enrollment period, multiple records are allowed for the member, with each record containing one continuous enrollment period. User does not have to bridge the multiple enrollment periods. For members with multiple enrollment records, start date and end date should not overlap among the records.
- 3) Inpatient Stay Claims should be rolled up to one claim per admission/discharge as shown in table 3.i. above.
 1. All diagnosis codes from claim line items within the same hospitalization event should be consolidated into a unique diagnosis code list and stored in the rolled-up claim, i.e. if the same diagnosis code is repeated in multiple claim lines, only one unique code needs to be kept in the rolled-up claim. User should apply appropriate methods to identify the principal diagnosis code in the rolled-up claim.
 2. All procedure codes from claim line items within the same hospitalization event should also be consolidated into a unique procedure code list and stored in the rolled-up claim, i.e. if the same procedure code is repeated in multiple claim lines, only a unique code needs to be kept in the rolled-up claim. User should apply appropriate methods to identify the principal procedure code in the rolled-up claim.
 3. For purposes of identifying bilateral procedures as necessary in Hip or Knee procedures, the DRG codes could be used during the data preparation phase to identify patients who had a bilateral procedure and these members could be excluded. If users do not exclude patients who have stay claims with bilateral procedures during the data preparation phase, they can remove these patients at the reconciliation phase at the end to ensure that higher costs associated with a bilateral procedure does not artificially inflate the ECR® budget.
 4. All revenue codes from claim line items within the same hospitalization event should be consolidated into unique revenue code list and stored in the rolled-up claim. Revenue codes do *not* form an important component of the Prometheus model and are mostly important to help identify emergency room visits in stay records and certain exclusionary criteria such as use of dialysis, oncology services etc. If it is difficult to consolidate revenue codes to the unique one-member-one-stay record, it may be appropriate *not* to use revenue codes at all so long as the emergency room visits are identified and flagged separately.

- 4) Professional, Outpatient Facility, Ancillary and Other Claims should NOT be rolled up, but should remain at claim line level.
- 5) Pharmacy claim should keep one NDC code per claim.

2.3 Calculating Total Reimbursed Allowed Amount (\$)

The cost field used in developing the ECR® price is the “Total Reimbursable Allowed Amount” and represents the amount paid to the provider by the insurance carrier plus the patient portion of the payment.

Medical Claims:

The “total reimbursable allowed amount” for each of the inpatient stay and professional claims is the sum of the following 6 values:

- 1) Paid Amount: Dollar amount paid by insurance carriers for covered services.
- 2) Deductible Amount: The amount of the cost of this service that the member must pay as applied to the total yearly deductible.
- 3) Co-pay Amount: Amount an individual member or insured individual pays directly to a provider at the time the services are rendered.
- 4) COB Amount: Amount paid by another insurance carrier as the result of coordination of benefits.
- 5) Co-insurance Amount: The amount the insured individual pays as a set % cost of covered medical services as out-of-pocket payment to the provider.
- 6) Medicare Savings Amount: Amount of savings the plan recognizes due to Medicare duplicate coverage status of the member at time of service.

The “total reimbursable allowed amount” cost field needs to be constructed using the equivalent of the six cost fields described above from your database.

Pharmacy Claims:

The “total reimbursable allowed amount” for pharmacy claims is the sum of the following 4 values:

- 1) Paid Amount: Dollar amount paid by insurance carriers for covered services (Cost per metric drug unit x Number of metric units)
- 2) Co-pay Amount: Amount an individual member or insured individual pays directly to a provider at the time the services are rendered
- 3) COB Amount: Amount paid by another insurance carrier as the result of coordination of benefits
- 4) Medicare Savings Amount: Amount of savings the plan recognizes due to Medicare duplicate coverage status of the member at time of service

The “total reimbursable allowed amount” cost field needs to be constructed using the equivalent of the four cost fields described above from your database.

2.4 File Formats and Field Mapping for Input Datasets

Users should convert and format their healthcare data into the following SAS datasets, so that the attached SAS programs can use them as input datasets.

2.4.1 General Instruction:

- 1) All of the variables listed should be created using the indicated variable name, type, length, and format (if applicable).
- 2) It is possible that the source data do not contain certain required fields, such as CPT codes in inpatient stay claims or ICD-9 procedure codes in outpatient/professional claims. If a required field cannot be mapped in the source data, a blank column **MUST** be created as place holder using the indicated variable name, type, and length.
- 3) All ICD-9 codes should be left justified. Leading and trailing zeros should be included. The program can use both ICD-9 codes coded with or without decimal points (Example: 021.8 can be formatted as 021.8 or 0218).
- 4) For variables with defined code (e.g., sex, place of service, type of claims, etc), the input data must be verified for consistency with indicated coding definition. The input data have to be recoded if the definitions do not match to the Prometheus definitions.
- 5) The user can include as many diagnoses and procedures as desired, following the naming convention indicated for each addition variable. For variables naming with X, X indicate the additional variables. User can customize the number to include all available data in that category in the input data. For example, if the input data have a maximum of four CPT codes in a claim, the first CPT code should be assigned to HCPCS_PROC_CODE, and the additional 3 CPT codes should be assigned to CPTCODE1 to CPTCODE3, respectively (X = 3). X does not have to be same across different categories (ICD-9 procedure/ICD-9 diagnosis/CPT/revenue). However, for each category X must > 1. For example you may have only one CPT code in the outpatient/professional claims, which should be named as HCPCS_PROC_CODE, you should still create a blank CPTCODE1 column as the place holder.
- 6) For each CPT field, a corresponding CPT modifier field must be included, i.e., CPTCODEX and CPTCODE_MODX have to be a pair in the input data with same X.
- 7) NDC codes should be 11 characters. Hyphens should be removed. Leading and trailing zeros should be included. For example, 00000-1435-00 should be formatted as 00000143500.
- 8) All calendar dates should be read in as a SAS date value rather than a character or standard numeric value.
- 9) Optional Provider ID: The ID that identifies the serving hospital or the performing physician (such as the claim organization NPI number or the claim performing physician NPI number).
This field is not needed for running Prometheus standard analysis. It would be useful if user wishes to perform provider analysis. Patients could be attributed to providers based on the information in this field.
- 10) Optional Provider Specialty: CMS specialty code used for pricing the line item service on the noninstitutional claim. This field is not needed for running Prometheus standard analysis. It would be useful if user wishes to perform provider analysis. Patients could be attributed to providers based on the information in this field.

2.4.2 Field Mapping and File Formats

Users should follow the variable name, type, length, and format indicated in the following tables to prepare the input SAS data files.

Variable	Type	Length	Description
CONSISTENT_MEMBER_ID	Char	(varies by data)	Unique member ID.
SEX	Char	1	Patient gender F = Female M = Male
YOB	Num	8	Member's year of birth. Coded as YYYY (e.g., 1965).
Member Zip Code (<i>optional</i>)	Char	5	Member's zip code (not needed for running Prometheus standard analysis. Will be needed if user wishes to perform additional regional variation analysis).

Variable	Type	Length	Description
CONSISTENT_MEMBER_ID	Char	(varies by data)	Unique member ID.
BEGIN_DATE_s	Num	8	Member enrollment effective date (SAS date).
END_DATE_s	Num	8	Member enrollment termination date (SAS date). If a member is still enrolled, leave this field blank.

Variable	Type	Length	Label and/or Description
CONSISTENT_MEMBER_ID	Char	(varies by data)	Unique member ID.
PROVIDER ID	Char	(varies by data)	The ID that identifies the serving hospital, such as the claim organization NPI number.
ALLOWED_AMT	Num	8	Total Reimbursed Allowed Amount. Please do not include dollar sign. See Section 2.3 for the calculation of Total Reimbursed Allowed Amount.
FROM_DATE_s	Num	8	First Date of Service (SAS date).
THRU_DATE_s	Num	8	Last Date of Service (SAS date).

Variable	Type	Length	Label and/or Description
DISCHARGE_STATUS	Char	2	Code indicating status at discharge from the hospital, as defined in the Medicare Carrier manual for the claim. This field is used to identify left against medical advice (LAMA) or death. Codes that will be used by the Prometheus program are listed below. ‘07’ = Left against medical advice or discontinued care ‘20’ = Expired (or did not recover - Christian Science patient). ‘40’ = Expired at home (hospice claims only). ‘41’ = Expired in a medical facility (e.g. hospital, SNF, ICF or free standing hospice). (Hospice claims only) ‘42’ = Expired - place unknown (hospice claims only). Other discharge status is allowed in this field, as long as above status is coded as indicated.
ADMIT_TYPE_CODE	Num	1	Type of Admission/Source of Admission. This field is used to identify admission through emergency room. 1 = Emergency room service 0 = Not emergency room service If no such a field is directly available in the original claims data, the user should use other source of information to identify ER services and populate this field as indicated.
PLACE_OF_SVC_CODE	Char	2	Place of service. This field is used to identify emergency room service. ‘23’ = Emergency Room Other place of service codes are allowed in this field, as long as emergency room is coded as indicated.
TYPE_OF_CLAIM	Char	1	Type of claim: this field should be generated by the user. ‘1’= Inpatient Facility Claims ‘2’= Outpatient Facility Claims ‘3’= Professional, Ancillary and Other Claims The inpatient stay claims file should only contain claims that carry a ‘1’ for this field.
REV_CPTX	Char	5	Revenue Code <i>X (Nx)</i>
HCPCS_PROC_CODE	Char	5	HCPCS CPT4 Procedure Code.
HCPCS_CPT_MOD	Char	2	Initial (functional) CPT modifier for HCPCS_PROC_CODE
CPTCODEX	Char	5	Additional HCPCS CPT4 Procedure Code <i>X (NI)</i>
CPTCODE_MODX	Char	2	Initial (functional) CPT modifier for CPTCODEX <i>(NI)</i>
PRINCIPAL_DIAG_CODE	Char	6	ICD-9 Principal Diagnosis code
SECONDARY_DIAGX_CODE	Char	6	ICD-9 Secondary Diagnosis code <i>X (N2)</i>

Variable	Type	Length	Label and/or Description
PRINCIPAL_PROC_CODE	Char	6	ICD-9 Principal Procedure code
PROC_ICD9_2NDX	Char	6	ICD-9 Secondary Procedure code <i>X</i> (<i>N3</i>)

Where *X* could be any of the values below:

- N1 represents a fixed number of multiple CPT Codes on claims.
- N2 represents a fixed number of multiple ICD-9 Diagnosis Codes on claims.
- N3 represents a fixed number of multiple ICD-9 Procedure Codes on claims.
- N1, N2, and N3 should be determined by the user during extract based on available data.
- Nx (Revenue codes are mostly important to help identify emergency room visits in stay records: 45x and certain exclusionary criteria such as use of dialysis: 80x, oncology services 28x and labor & delivery: 72x)

For reference, in the Prometheus developmental database N1=20; N2=9; N3=21; and Nx=20.

Variable	Type	Length	Label and/or Description
CONSISTENT_MEMBER_ID	Char	(varies by data)	Unique member ID.
ALLOWED_AMT	Num	8	Total Reimbursed Allowed Amount. Do not include dollar sign. See Section 2.3 for the calculation method.
PROVIDER ID	Char	(varies by data)	This ID identifies the performing physician, such as the claim performing physician NPI number on a professional claim and the claim organization ID number on an outpatient facility claim.
SPECIALTY	Char	2	CMS specialty code used for pricing the line item service on the noninstitutional claim. Specialty Codes that will be used by the Prometheus program are listed below. 01 = General practice 08 = Family practice 11 = Internal medicine 16 = Obstetrics/gynecology 37 = Pediatric medicine 38 = Geriatric medicine 84 = Preventive medicine 06 = Cardiology 46 = Endocrinology 29 = Pulmonology 10 = Gastroenterology 13 = Neurology
FROM_DATE_s	Num	8	First Date of Service (SAS date).
THRU_DATE_s	Num	8	Last Date of Service (SAS date) – usually FROM_DATE and THRU_DATE is the same in PFO claims.
PLACE_OF_SVC_CODE	Char	2	Place of service. This field is used to identify emergency room service. ‘23’ = Emergency Room Other place of service codes are allowed in this field, as

Variable	Type	Length	Label and/or Description
			long as emergency room is coded as indicated.
TYPE_OF_CLAIM	Char	1	Type of claim: this field should be generated by the user. '1'= Inpatient Facility Claims '2'= Outpatient Facility Claims '3'= Professional, Ancillary and Other Claims The professional, outpatient facility, ancillary and other claims file should only contain claims that have a '2' and '3' for this field.
HCPCS_PROC_CODE	Char	5	HCPCS CPT4 Procedure Code.
HCPCS_CPT_MOD	Char	2	Initial (functional) CPT modifier for HCPCS_PROC_CODE
CPTCODEX	Char	5	Additional HCPCS CPT4 Procedure Code <i>X (N1)</i>
CPTCODE_MODX	Char	2	Initial (functional) CPT modifier for CPTCODEX (<i>N1</i>)
PRINCIPAL_DIAG_CODE	Char	6	ICD-9 Principal Diagnosis code
SECONDARY_DIAGX_CODE	Char	6	ICD-9 Secondary Diagnosis code <i>X (N2)</i>
PRINCIPAL_PROC_CODE	Char	6	ICD-9 Principal Procedure code
PROC_ICD9_2NDX	Char	6	ICD-9 Secondary Procedure code <i>X (N3)</i>

Where *X* could be any of the values below:

- N1 represents a fixed number of multiple CPT Codes on claims.
- N2 represents a fixed number of multiple ICD-9 Diagnosis Codes on claims.
- N3 represents a fixed number of multiple ICD-9 Procedure Codes on claims.
- N1, N2, and N3 should be determined by the user during extract based on available data.

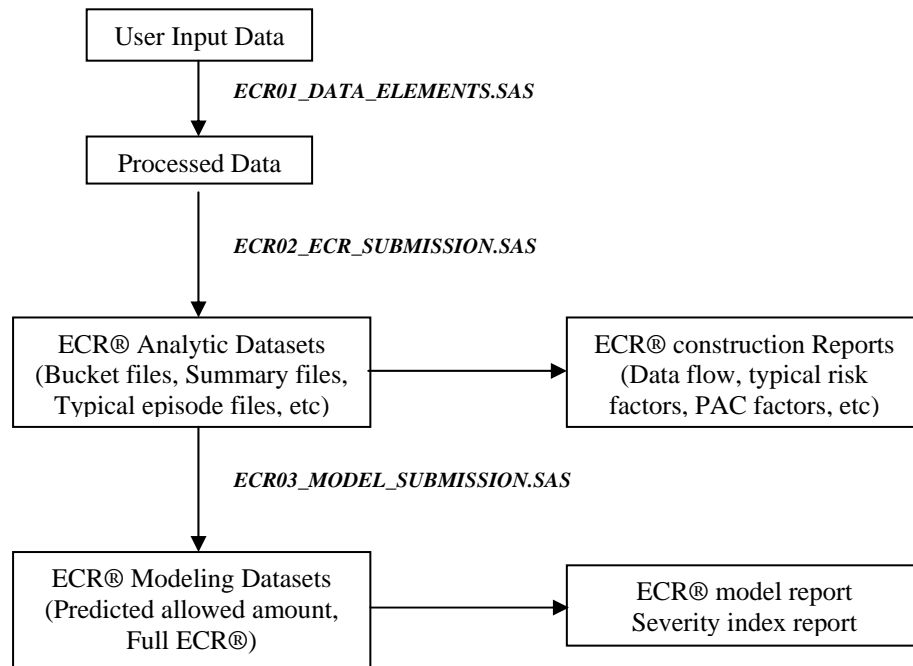
For reference, in the Prometheus developmental database N1=4; N2=5; and N3=4.

Variable	Type	Length	Label and/or Description
CONSISTENT_MEMBER_ID	Char	(varies by data)	Unique member ID.
ALLOWED_AMT	Num	8	Total Reimbursed Allowed Amount. Please do not include dollar sign. See Section 2.3 for the calculation of Total Reimbursed Allowed Amount.
NDC_CODE	Char	11	NDC Drug Code. NDC codes should be 11 characters. Hyphens should be removed. Leading and trailing zeros should be included. For example, 00000-1435-00 should be formatted as 00000143500.
SUPPLY_DAYS_NUM	Num	8	Number of days of prescription supply
PRESCRIPTION_FILLED_DATE_S	Num	8	Date of prescription filled (SAS date).

3 ECR® construction

This section describes how to run the SAS programs to create the ECR® datasets. The overall process of constructing ECR® datasets is outlined in Figure 1.

Figure 1 Diagram of ECR® Construction Process



3.1 Instructions for Running SAS Programs to Create ECR® Datasets

3.1.1 Creating folders for storing SAS programs, data files, and reports

Create eight custom-named but separate folders within a working area on the hard drive or network drive according to the following bulleted list. These are the necessary folders needed to construct the ECR® datasets and manage program output. The user may name each folder any name to provide identifiable recognition of its purpose, however, avoid using special characters especially the ampersand (&) to not confuse SAS. Underscores (_) are fine. The user will later enter these folder pathnames into the SAS program.

- 1) A folder storing the required 5 user input datasets (a macro variable CLAIMDATA is referred to this folder).
- 2) A folder storing Prometheus Meta datasets (a macro variable METADATA is referred to this folder).
- 3) A folder storing all Prometheus standard SAS programs (a macro variable PROGRAM_LOC is referred to this folder).

- 4) A folder storing all SAS macro programs that will be called by Prometheus standard SAS programs (a macro variable MACROFILE is referred to this folder).
- 5) A folder storing all standard model coefficient data that will be used in ECR® modeling steps (a macro variable MODEL is referred to this folder).
- 6) A folder storing processed enrollment and claims data that will be further used for constructing each ECR® (a macro variable ECR® is referred to this folder). The Prometheus program reads the 5 original source data files (as constructed in Tables 2-6) and outputs processed data into this folder for further use in creating each ECR®.
- 7) A folder storing all SAS permanent datasets for each ECR® (a macro variable ANALYTIC is referred to this folder).
- 8) A folder storing all Excel reports for each ECR® (a macro variable FILELOC will refer to this folder).

After the folders are created, unzip and place the supplied Prometheus SAS program and data files to the appropriate folders.

Note:

If the users are running multiple health plans' data separately, make sure to create a new set of folders as described above for each health plan. If different health plan's data was pointed to the same folder for saving output dataset and reports, the results generated earlier will be overwritten by the results generated later.

If the users have to rerun same ECRs on same data, we also recommend the users to remove or delete the SAS datasets and excel reports from the earlier runs, as the new output files may be named differently and may not always overwrite the old outputs.

3.1.2 Enter user settings in ECR00_COMMON_MACRO.sas

Before running the SAS programs, user-defined folder pathnames and parameters should be entered into ECR00_COMMON_MACRO.sas as instructed. This program sets values for global macro variables (e.g. location of input/output files, study periods, etc.) that will be used by other SAS programs. The program is divided into three main sections:

- 1) a section containing macro variables that the user is required to set;
- 2) a section containing macro variables with default values, which the user can change if desired;
- 3) a section containing macro variables with values that the user is not allowed to make any changes.

Open the program in the SAS Editor and read through the section of the program under

```
*****
**** USER SETTING SECTION ****
*****
```

Enter values where needed and stop at the end of this section. The required settings and descriptions have been summarized in the table 7.

Table 7: ECR00_COMMON_MACRO.sas Required User Settings	
Required User Settings	Description
%LET USER=;	Enter user information. Example: %LET USER=XXX AT COMPANY;
Locations of datasets and reports	
%LET CLAIMDATA=;	Enter the location of source SAS datasets (including all 5 data files as constructed in Tables 2-6). Example: %LET CLAIMDATA=C:\SOURCE DATA;
%LET METADATA=;	Enter the location of meta data. Example: %LET METADATA=C:\ECR METADATA;
%LET MACROFILE=	Enter the location of SAS macro files. Example: %LET MACROFILE=C:\ECR MACRO;
%LET ECR=;	Enter the location for storing the intermediate SAS datasets. These datasets are generated from the source data files and are the common data that will be used to create each ECR®. Example: %LET ECR=C:\ECR DATASET;
%LET ANALYTIC=;	Enter the location for storing ECR® analytic SAS datasets. Example: %LET ANALYTIC=C:\ECR ANALYTIC;
%LET FILELOC=;	Enter the location for storing ECR® Excel reports. Example: %LET ECR=C:\MY REPORT;
%LET MODEL=	Enter the location for storing standard model coefficient data. Example: %LET MODEL=C:\MY MODEL COEFF;
Name of enrollment and claims datasets	
%LET CLM_MEMBER=;	Enter member file name. Example: %LET CLM_MEMBER=MEMBER;
%LET CLM_ELIG=;	Enter member enrollment file name. Example: %LET CLM_ELIG=MEM_ENROLL;
%LET CLM_IP=;	Enter inpatient/stay claims file name. Example: %LET CLM_IP=STAY;
%LET CLM_OP=;	Enter outpatient, professional, ancillary and other claims file name. Example: %LET CLM_OP=PROF;
%LET CLM_RX=;	Pharmacy claims file name. Example: %LET CLM_RX=PHARMACY;
Total number of diagnosis/procedure/revenue fields in claims datasets	

Table 7: ECR00_COMMON_MACRO.sas Required User Settings		
Required User Settings	Description	
Inpatient Claims	%LET IPDX=; Example: %LET IPDX=4;	Enter total number of diagnosis fields including principal diagnosis in the inpatient stay file. Example: %LET IPDX=4;
	%LET IPPX=; Example: %LET IPPX=3;	Enter total number of procedure fields including principal procedure in the inpatient stay file. Example: %LET IPPX=3;
	%LET IPCPT=; Example: %LET IPCPT=3;	Enter total number of CPT fields including hcpcs_proc_code in the inpatient stay file. Example: %LET IPCPT=3;
	%LET REV_CPT=; Example: %LET REV_CPT=3;	Enter total number of revenue fields in the inpatient stay file. Example: %LET REV_CPT=3;
Outpatient/professional claims	%LET OPDX=; Example: %LET OPDX=4;	Enter total number of diagnosis fields including principal diagnosis in the PFO file. Example: %LET OPDX=4;
	%LET OPPX=; Example: %LET OPPX=3;	Enter total number of procedure fields including principal procedure in the PFO file. Example: %LET OPPX=3;
	%LET OPCPT=; Example: %LET OPCPT=3;	Enter total number of CPT fields including hcpcs_proc_code in the PFO file. Example: %LET OPCPT=3;
%LET STUDY_START=MDY(,,); %LET STUDY_END=MDY(,,);	Enter the start and end dates of the study period - the study period should ideally be at least two years long to capture more complete ECRs®. For example, if the study period is from Jan 1, 2006 to Dec 31, 2007, then enter %LET STUDY_START=MDY(1,1,2006) %LET STUDY_END=MDY(12,31,2007);	

Read through the next section under

```
*****
**** DEFAULT SETTING SECTION ****
*****
```

This section includes default settings that we strongly recommend users to use. This ensures consistency in outputs and will help comparisons across Prometheus SAS program users. However, users are allowed to change the default values to other values. The default settings and descriptions have been summarized in table 8.

Table 8: ECR00_COMMON_MACRO.sas Default Settings	
Default Settings	Description
Chronic group %LET AGE_DM=18; %LET AGE_CHF=18; %LET AGE_COPD=18; %LET AGE_HTN=18; %LET AGE_CAD=18; %LET AGE_ASTHMA=2; %LET AGE_GERD=18; Inpatient Procedural (IPP) group %LET AGE_HIPR=18; %LET AGE_KNEE=18; %LET AGE_CABG=18; %LET AGE_COLON=18; %LET AGE_BARI=18; Inpatient Medical (IM) group %LET AGE_AMI=18; %LET AGE_PNE=18; %LET AGE_STR=18; Outpatient Procedural (OPP) group %LET AGE_PCI=18; %LET AGE_COLOS=18; %LET AGE_PREG=10; %LET AGE_GALL=18; %LET AGE_HYST=18; %LET AGE_KNRP=18;	Patient minimum age cut-Off. All reports will only include patients whose age at index trigger is equal to or above the minimum age.
%LET MAX_AGE=65;	Patient maximum age cut-off. All reports will only include patients whose age at index trigger is under the maximum age. If user does not wish to have a maximum age limit, they can put MAX_AGE=120;

Table 8: ECR00_COMMON_MACRO.sas Default Settings

Default Settings	Description
<p>Chronic group %LET ENROLLMENT_CH=365; %LET PRIOR_CH=0; %LET FOLLOWUP_CH=365;</p> <p>Inpatient Procedural (IPP) group; %LET PRIOR_IPP=30; %LET FOLLOWUP_IPP=180;</p> <p>Inpatient Medical (IM) group; %LET PRIOR_IM=0; %LET FOLLOWUP_IM=30;</p> <p>Outpatient Procedural (OPP) group; %LET PRIOR_PCI=60; %LET FOLLOWUP_PCI=180;</p> <p>%LET PRIOR_GALL=60; %LET FOLLOWUP_GALL=180;</p> <p>%LET PRIOR_KNRP=60; %LET FOLLOWUP_KNRP=180;</p> <p>%LET PRIOR_HYST=60; %LET FOLLOWUP_HYST=180;</p> <p>%LET PRIOR_COLOS=7; %LET FOLLOWUP_COLOS=30;</p> <p>%LET PRIOR_PREG=252; %LET PRIOR_MIN=90; %LET FOLLOW_PREG=56;</p>	<p>ENROLLMENT is the minimum required continuous enrollment from the start of the look-back duration. For chronic ECRs® the default minimum continuous enrollment 365 covers the default episode period, but users can reset the value. For other ECRs®, the minimum continuous enrollment automatically covers the duration from the start of the look-back to the end of the follow-up and is not allowed to be reset separately.</p> <p>PRIOR is the look-back duration (in days) from the start of the index trigger.</p> <p>FOLLOWUP is the duration of an episode (in days) from the end of the index trigger.</p> <p>For Chronic, IPP and IM, the look-back and follow up period are set at category level, so that ECRs® under the same category always use the same settings. For OPP, the settings are adjustable at the single ECR® level.</p>
<p>%LET BREAK_IPP=30; %LET BREAK_CH=30; %LET BREAK_OPP=30; %LET BREAK_IM=0;</p>	<p>Enrollment gap day allowance. A gap of no more than the default value is allowed in the continuous enrollment period. This gap can be changed based on user preference but we recommend for the sake of consistency to keep the default settings.</p>
<p>%LET GRACE=2;</p>	<p>Grace period in number of days for defining inpatient stay-associated outpatient/professional claims. Any outpatient/professional claims within +/- grace period of a stay are defined as stay associated claims.</p>

Default Settings	Description
<pre>%LET PFO_MIN_AMT=10; %LET STAY_MIN_AMT=50; %LET RX_MIN_AMT=1; %LET CLAIM_MAX_AMT=1000000; %LET SUM_MINIMUM=20; %LET SUM_MAX=1000000;</pre>	<p>Cut-off of valid allowed amt. Claims with allowed amount out of the ranges are dropped as invalid or outlier claims.</p> <p>Claim level: minimum \$10 for outpatient/professional claims (pfo_min_amt) \$50 for inpatient/stay claims (stay_min_amt) \$1 for pharmacy claims (rx_min_amt); maximum \$1 million for all types of claims</p> <p>Episode level: minimum \$20 for total medical costs (inpatient/outpatient/professional) in the episode maximum \$1 million for total medical costs (inpatient/outpatient/professional) in the episode maximum \$1 million for all pharmacy costs in the episode maximum \$2 million for all relevant costs in the episode</p>

The section after default settings

```

/*****\
      NO ANY CHANGES ALLOWED BELOW
\*****/
does not allow users to make any changes.
```

After values for all the macro variables have been set, save and close the program. There is no need to run (i.e. to submit) the ECR00 program, as it will be “included” in other s when needed using the SAS %include syntax.

3.1.3 Run ECR01_DATA_ELEMENTS.sas to create common data files.

After ECR00 user’s settings have been saved, user can run ECR01_DATA_ELEMENTS.sas. This program processes user’s source member and claims data to create a new set of data files that can be used to generate each ECR®. Major steps completed through this program include assigning CCS codes and Prometheus Drug ID codes, produce source data summary, etc. The data files produced from this program are stored in the location assigned by the user (%LET ECR=).

Open the program in the SAS Editor and locate the section underneath the title

```

*****
**** USER SETTING SECTION ****
*****;
```

Enter the pathname to the folder which contains all of the Prometheus SAS program files at

```
** LOCATION OF SAS PROGRAMS;
** Example: %LET PROGRAM_LOC= C:\ECR PROGRAM;
%LET PROGRAM_LOC=;
```

After the program location is entered, save and run (i.e. submit) the ECR01 program, and close it when it is finished running.

Notes:

1. Program location is the only setting that requires user's input. No other changes are allowed in the ECR01 program.
2. Usually ECR01 only needs to be run once for all ECRs®. However, if any of the source data files are changed or any of the following settings in ECR00 are changed after ECR01 has been run, then the user has to rerun ECR01.

```
%LET CLAIMDATA=;
%LET METADATA=;
%LET ECR=;

%LET CLM_MEMBER=;
%LET CLM_ELIG=;
%LET CLM_IP=;
%LET CLM_OP=;
%LET CLM_RX=;

%LET IPDX=;
%LET IPPX=;
%LET IPCPT=;
%LET REV_CPT=;
%LET OPDX=;
%LET OPPX=;
%LET OPCPT=;

%LET STUDY_START=MDY( , , );
%LET STUDY_END=MDY( , , );
%LET EMERGENCY=;

%LET PFO_MIN_AMT=;
%LET STAY_MIN_AMT=;
%LET RX_MIN_AMT=;
%LET CLAIM_MAX_AMT=;
```

Changing ECR00 settings not listed above after running ECR01 does not require the rerun of ECR01.

3. The following steps are conducted in ECR01 steps for data cleaning.
 - i. All claims with ALLOWED_AMT lower than the minimum cut-off or higher than the maximum cut-off are excluded as invalid claims.

- ii. For PFO claims:
 - a) If either “FROM_DATE_S” or “THRU_DATE_S” is missing – the missing date is imputed using the other date;
 - b) If the difference between “THRU_DATE_S” and “FROM_DATE_S” is >100 days, then the claim is excluded as an invalid claim.

3.1.4 Run ECR02_ECR_SUBMISSION.sas to create each ECR®.

After running ECR01 program is completed, user can run ECR02_SUBMISSION.sas to generate each ECR®. ECR02 program uses the data files created through ECR01 program and produce analytic data and reports for each ECR® separately.

Open the program in the SAS Editor and locate the section underneath the title

```
*****
**** USER SETTING SECTION ****
*****;
```

Enter the pathname to the folder which contains all of the Prometheus SAS program files at

```
** 1) LOCATION OF SAS PROGRAMS;
**   Example: %LET PROGRAM_LOC= C:\ECR PROGRAM;
```

```
%LET PROGRAM_LOC=;
```

Enter the names of ECRs® to be generated. User must use the standard ECR® names listed in table 1.

```
** 2) NAMES OF ECR;
**   Example: %LET ECR_NAME= CHF CAD HIPR;
```

```
%LET ECR_NAME=;
```

The title “NO CHANGES ALLOWED BELOW” marks the place below which no more changes are allowed. Save and run (i.e. submit) this program, and close it when it is finished running.

Notes:

- 1) Multiple ECRs® can be run together or individually. Enter the desired ECR® names separated by a space. If the size of the outpatient claims dataset is greater than 1 GB, submit 1 to 3 ECRs® at a time.
- 2) If user’s settings in ECR00 are changed, then ECR02 program has to be rerun. Depending on the fact that if the changed settings are applied to all ECRs®, an ECR® category, or a specific ECR® alone, the user can determine which ECRs® should be rerun.
- 3) If ECR01 program has been rerun for any reason, then ECR02 program should be rerun for all ECRs®.

3.2 Reports from ECR® Construction Programs

The ECR01 and ECR02 programs generate the following Excel reports:

Table 9: ECR® Reports	
Name of Report File	Contents
Common report (one set for all data)	
GENERAL_DATA_SUMMARY	This report shows the summary information for all original data submitted by the users and the valid data included in the study period for ECRs®. This includes the number of patients and their associated stay records, professional records, and pharmacy records as well as their associated costs.
CORE_PRICE_INFO	This report shows the average unit cost for core services, calculated using outpatient/professional claims. These services and their costs are used to determine the gaps in care and the care coordination (underuse) amount at the patient level for each chronic medical ECR®.
ECR®-specific report (one set Per ECR®. Numbers of reports vary by ECR® category. ECR® name in the file name is omitted)	
Chronic ECR® Reports	
DATA_FLOW	This table shows how patients with trigger claims are filtered through enrollment, eligibility, and exclusion criteria to generate final ECR® datasets with relevant claims. Number of unique patients and corresponding claims, total/average allowed amounts, standard deviations, and allowed amount distribution at each major filtering step are included. The final rows of the output table describe the counts and associated costs for 1) all relevant claims in an ECR®, 2) for “typical” services and 3) for potentially avoidable complications (PACs); each broken down by inpatient stay, outpatient facility, professional, and pharmacy claims. This output is a summary of the patient level intermediate SAS table that gets generated based on the actual number of patients, their claims experience, and how they were classified using the Prometheus ECR® process. The proportion of total dollars spent for care of PACs is calculated at the end of the report as the “PAC rate”.
DATA_FLOW_OVERVIEW	This is the overview of all relevant episodes in the final ECR® datasets. Total / average allowed amount, and standard deviations are calculated based on the total number of all episodes for the medical condition under study. This represents an actuarial analysis to study the proportion of costs contributed by each subgroup within the ECR®.
TYPICAL_STAY	This report shows the frequency and percentage of typical risk factors that are flagged among typical inpatient stay claims. All diagnoses, procedure, and revenue codes on these claims are searched for flagging typical risk factors. For chronic conditions, only GERD and CAD, which allow “typical” inpatient stays, have this report. For the other five chronic conditions (hypertension, diabetes, CHF, COPD and Asthma), all stays are regarded as PACs, therefore, they have no typical stays.
TYPICAL_PROF	This report shows the frequency and percentage of typical risk factors that are flagged among typical professional, outpatient facilities, other ancillary, and pharmacy claims. All diagnoses, procedure, and NDC codes on these claims

Table 9: ECR® Reports	
Name of Report File	Contents
	are searched for flagging risk factors.
PAC_STAY	For ECRs® including DM, Asthma, CHF, COPD, and HTN, this report shows the frequency and cost based on the principal diagnosis for PAC inpatient stays. Stays are counted only once and the principal diagnosis may belong to a typical or a PAC category, but identifies the reason a patient was admitted for the stay. For GERD and CAD, this report shows the frequency and cost of each type of PAC event that occurred in the PAC inpatient stay claims.
PAC_PROF	This report shows the frequency and cost of each type of PAC event that occurred in the professional, outpatient facilities, and other ancillary claims. All diagnoses and procedure codes on the claims are searched for PAC events and included in the PAC count, therefore counting the same patient for more than one PAC category is allowed.
CORE_PRICE	This report shows the user-specific cost of core services for the ECR®. It is calculated based on the average unit cost and the number of services recommended based on evidence informed guidelines during the episode period for each ECR®. This report is generated only for the chronic medical conditions and helps determine the underuse / care coordination amount for these ECRs®.
Inpatient Procedural/Inpatient Medical ECR® Reports	
DATA_FLOW	This table shows how patients with trigger claims are filtered through enrollment, eligibility, and exclusion criteria to generate final ECR® datasets with relevant claims. Number of unique patients and corresponding claims, total/average allowed amounts, standard deviations, and allowed amount distribution at each major filtering step are included. The final rows of the output table describe the counts and associated costs for 1) all relevant claims in an ECR®, 2) for “typical” services and 3) for potentially avoidable complications (PACs); each broken down by inpatient stay, outpatient facility/professional, and pharmacy claims. The last two rows in the report show data for typical and PAC inpatient readmissions. This output is a summary of the patient level intermediate SAS table that gets generated based on the actual number of patients, their claims experience, and how they were classified using the Prometheus ECR® process. The proportion of total dollars spent for care of PACs is calculated at the end of the report as the “PAC rate”.
DATA_FLOW_OVE RVIEW	This is the overview of all relevant episodes in the final ECR® datasets. Total / average allowed amount, and standard deviations are calculated based on the total number of all episodes for the medical condition under study. This represents an actuarial analysis to study the proportion of costs contributed by each subgroup within the ECR®.
TYPICAL_INDEX_ STAY	This report shows the frequency and percentage of typical risk factors that are flagged among typical index inpatient stay claims. All diagnoses, procedure, and revenue codes on these claims are searched for flagging typical risk factors.
TYPICAL_READMI	This report shows the frequency and cost based on the principal diagnosis for

Table 9: ECR® Reports	
Name of Report File	Contents
T_STAY	“typical” inpatient stay readmissions. Stays are counted only once. The principal diagnosis identifies the reason a patient was readmitted for the stay. Not all ECRs are allowed to have typical readmissions.
TYPICAL_PROF	This report shows the frequency and percentage of typical risk factors that are flagged among typical outpatient facility, professional, other ancillary, and pharmacy claims. All diagnoses, procedure, and pharmacy codes on these claims are searched for flagging typical risk factors.
PAC_INDEX_STAY	This report shows the frequency and cost of each type of PAC event that occurred in the PAC index inpatient stay claims.
PAC_READMIT_STAY	Not all readmissions are PACs. This report looks at the readmissions that were classified as PACs and shows the frequency and cost of each type of PAC event that occurred. If the stay did not have a pre-defined PAC event, the readmission is identified by the principal diagnosis code on the readmission.
PAC_PROF	This report shows the frequency and cost of each type of PAC event that occurred in the PAC outpatient facility and professional claims.
Outpatient Procedural ECR® Reports	
DATA_FLOW	This table shows how patients with trigger claims are filtered through enrollment, eligibility, and exclusion criteria to generate final ECR® datasets with relevant claims. Number of unique patients and corresponding claims, total/average allowed amounts, standard deviations, and allowed amount distribution at each major filtering step are included. The final rows of the output table describe the counts and associated costs for 1) all relevant claims in an ECR®, 2) for “typical” services and 3) for potentially avoidable complications (PACs); each broken down by inpatient stay, outpatient facility, professional, and pharmacy claims. This output is a summary of the patient level intermediate SAS table that gets generated based on the actual number of patients, their claims experience, and how they were classified using the Prometheus ECR® process. The proportion of total dollars spent for care of PACs is calculated at the end of the report as the “PAC rate” for the given ECR®.
DATA_FLOW_OVERVIEW	This is the overview of all relevant episodes in the final ECR® datasets. Total / average allowed amount, and standard deviations are calculated based on the total number of all episodes for the medical condition under study. This represents an actuarial analysis to study the proportion of costs contributed by each subgroup within the ECR®.
TYPICAL_INDEX_STAY	This report shows the frequency and percentage of typical risk factors that are flagged among typical index inpatient stay claims. All diagnoses, procedure, and revenue codes on these claims are searched for flagging typical risk factors.
TYPICAL_INDEX_FACI	This report shows the frequency and percentage of typical risk factors that are flagged among typical index outpatient facility claims. All diagnoses and procedure codes on these claims are searched for flagging typical risk factors.
TYPICAL_PROF	This report shows the frequency and percentage of typical risk factors that are flagged among professional, other ancillary, and pharmacy claims. All

Table 9: ECR® Reports	
Name of Report File	Contents
	diagnoses, procedure, and pharmacy codes on these claims are searched for flagging typical risk factors.
TYPICAL_ASSOC_ADMIT_STAY	This report shows the frequency and cost based on the principal diagnosis for “typical” inpatient stay claims that are associated with the index. Stays are counted only once. The principal diagnosis identifies the reason a patient was admitted for the stay. Not all ECRs are allowed to have typical IP readmissions.
TYPICAL_ASSOC_ADMIT_FACI	This report shows the frequency and cost based on the principal diagnosis for “typical” outpatient facility claims that are associated with the index. Claims are counted only once. The principal diagnosis identifies the reason a patient was admitted for the facility.
PAC_INDEX_STAY	This report shows the frequency and cost of each type of PAC event that occurred in the PAC index inpatient stay claims.
PAC_INDEX_FACI	This report shows the frequency and cost of each type of PAC event that occurred in the PAC index outpatient facility claims.
PAC_ASSOC_ADMIT_STAY	Admissions prior to the index admission as well as those after discharge are called associated admissions. This report shows the frequency and cost of each type of PAC event that occurred in the associated admissions that got classified as a PAC. If the stay did not have a pre-defined PAC event, the associated admission is identified by the principal diagnosis code on the stay.
PAC_ASSOC_ADMIT_FACI	This report shows the frequency and cost of each type of PAC event that occurred in the PAC outpatient facility claims that are associated with the index.
PAC_PROF	This report shows the frequency and cost of each type of PAC event that occurred in the PAC professional claims.

In all the reports above, the PAC events and their costs get double counted if the same claim has more than one PAC code. The unique patient count and the PAC costs associated with them are given at the end of the reports on a separate line defined as ACTUAL.

3.3 Important ECR® Analytical Data Files from ECR® Datasets Construction Programs

The ECR® dataset construction programs generate a set of permanent SAS data files (intermediate output files) that are saved in the directory referred by a macro variable ANALYTIC. Among these data files, the following are most useful for users. Be aware that although the ECR® reports only include patients within the study age range, the ECR® SAS datasets always include patients of all ages so that it is more flexible for the user to conduct additional analysis. The variable AGE_GROUP=1 flags patients within the study range.

1. Bucket file (named as *<ECR name>_bucket*, *<ECR name>_ip_bucket*, *<ECR name>_op_bucket*): This file is at the claims level. For chronic ECRs®, inpatient stay and PFO (professional, outpatient facility, ancillary) claims are combined into a single

bucket file (*<ECR name>_bucket*), whereas for all other ECRs®, two bucket files are created to contain inpatient stays (*<ECR name>_ip_bucket*) and PFO claims (*<ECR name>_op_bucket*) separately.

The bucket file contains all relevant medical claims that have been used to build up the ECR® episodes. It keeps all data fields in the original claim data file. In addition, each diagnosis and procedure code in the claim has been assigned with the corresponding CCS code. Each claim has been flagged for a typical or PAC assignment as well as the reason of the assignment (See Appendix Table A.1-A.7 for file contents).

2. Summary file (named as *<ECR name>_summary*): This file is at the patient level. It contains all relevant episodes and their associated allowed amounts. The allowed amount is broken down by typical and PAC and by professional, stay and pharmacy claims. This is the dataset that is used to create the ECR® data flow tables (See Appendix Table A.8-A.11 for file contents).
3. Sum Model Typical file: (named as *<ECR name>_sum_model_typical_<claim type>*): This file is at the patient level and is based on typical claims that went into the models. Each patient in this file is flagged with typical risk factors.
 - For chronic ECRs®, there is only one sum model typical professional file that includes all relevant patients that have any typical professional or outpatient facility allowed amounts. For GERD and CAD the typical stay claims are included in this single file. Typical risk factor flags are identified from patient's typical professional, outpatient facility and pharmacy claims (and also from typical stay claims for CAD and GERD). The sum of all typical allowed amounts is used for creating the risk-adjustment professional models.
 - For IPP and IM ECRs®, there are up to two (stay and prof) sum model typical files for each ECR®. The sum model typical stay file includes stay claims of all patients whose index inpatient stay is typical. The typical index stay claims help identify and flag risk factors that serve as independent variables in the risk-adjustment stay models. The allowed amount for the index stays is the dependent variable and is used for creating the risk-adjustment models for inpatient stays. The sum model typical prof file includes typical professional, outpatient facility and pharmacy claims for all patients whose index inpatient stay is typical. These claims help identify and flag typical risk factors that serve as independent variables in the risk-adjustment professional models. The sum of allowed amounts for the typical professional, outpatient facility and pharmacy claims is the dependent variable and is used for creating the risk-adjustment typical professional models.
 - For OPP ECRs®, there are up to three (stay, faci, prof) sum model typical files for each ECR®. The sum model typical stay file includes stay claims of all patients who have a typical index inpatient stay. Typical stay risk factor flags are identified from these patients' index stay claims. The index stay allowed amount is used for creating the risk-adjustment model for typical inpatient

stays. The sum model typical faci file includes outpatient facility claims of all patients who have a typical index outpatient facility. Typical outpatient facility risk factor flags are identified from these patients' index outpatient facility claims. The index facility allowed amount is used for creating the risk-adjustment models for typical outpatient facility. The sum model typical prof file includes all patients whose have either a typical inpatient stay index or a typical outpatient facility index. Typical prof risk factor flags are identified from these patients' typical professional and pharmacy claims. The sum of typical professional and pharmacy allowed amounts is used for creating the risk-adjustment typical professional models.

(See Appendix Table A.12 for the contents of sum model typical files).

4 ECR® Modeling

4.1 Run ECR03_MODEL_SUBMISSION.sas

After ECR02 program run is completed, a SAS data file is generated that contains typical episodes and typical risk factor flags for each ECR® and each claim type (i.e. inpatient stay, outpatient facility, professional etc.). Users may continue to run ECR03_MODEL_SUBMISSION.sas to generate risk-adjustment models, full ECR® prices, and severity index for each ECR®. This section describes how to run the SAS programs for this purpose.

Open the program ECR03_MODEL_SUBMISSION.sas in the SAS Editor and locate the section underneath the title

```
*****
**** USER SETTING SECTION ****
*****;
```

Enter the pathname to the folder which contains all of the Prometheus SAS program files at

```
** 1) LOCATION OF SAS PROGRAMS;
**   Example: %LET PROGRAM_LOC= C:\ECR PROGRAM;
```

```
%LET PROGRAM_LOC=;
```

Enter the names of ECRs® to be generated. User must use the standard ECR® names listed in table 1.

```
** 2) NAMES OF ECR;
**   Example: %LET ECR_NAME= CHF CAD HIPR;
```

```
%LET ECR_NAME=;
```

Read through the next section under

```
*****
**** DEFAULT SETTING SECTION ****
*****
```

This section includes default settings that we recommend users to use. However, users are allowed to change the default values to other values. The default settings and descriptions have been summarized in table 11.

Table 11: ECR03_MODEL_SUBMISSION.sas Default Settings	
Default Settings	Description
Settings for Modeling	

Table 11: ECR03_MODEL_SUBMISSION.sas Default Settings	
Default Settings	Description
Settings for Modeling	
%LET SAMPLE_MIN=15;	The minimum sample size that the program will produce risk-adjusted typical predicted allowed amount using Scoring 0-3. If the sample size is less than this number, the program will not calculate risk-adjusted allowed amount, full ECR® price, or severity index.
%LET SAMPLE_SCORE3=150;	The minimum sample size that the program will try to build user-specific models using Scoring 3 logic. If the sample size is less than this number, the program will use Scoring 1 or 0 to calculate risk-adjusted allowed amount and full ECR® price.
%LET SAMPLE_SCORE2=500;	The minimum sample size that the program will use Scoring 2 logic to normalize the model coefficients based on the CIP standard model and user-specific fee schedule, when user-specific modeling (Scoring 3) procedure has failed. If the sample size is less than this number, the program will use Scoring 1 or 0 to calculate risk-adjusted allowed amount and full ECR® price.
%LET PRED_N=3;	The minimum number of predictors for a model to be valid using Scoring 3 logic. If the number of predictors in the final model is less than this number, the user-specific model has failed and the program will use other logic (Scoring 1, 2 or 0) to calculate risk-adjusted allowed amount and full ECR® price.
%LET R2=0.1;	The minimum adjusted R square for a model to be valid using Scoring 3 logic. If the adjusted R square in the final model is less than this number, the user-specific model has failed and the program will use other logic (Scoring 1, 2 or 0) to calculate risk-adjusted allowed amount and full ECR® price.
Settings for Full ECR® Calculation	
%LET PRF=0.5;	PAC redistribution factor, i.e. the proportion of total added PAC amount that is allowed for re-distribution.
%LET FFPF=0.25;	Flat fee portion factor, i.e. the proportion of total redistributable PAC that is evenly assigned to each patient. Rest of the redistributable PAC is assigned to patients in proportion of each patient's risk-adjusted typical allowed amount.
%LET UAF=1;	Core service underuse adjustment factor, i.e. the proportion of the underuse of core service that will be compensated in full ECR® price (used for Chronic medical ECR® only).
%LET MF=0;	Margin factor, i.e. the proportion of total typical allowed amount that is added to the full ECR® as a margin cost.

The title “NO CHANGES ALLOWED BELOW” marks the place below which no more changes are allowed. Save and run (i.e. submit) this program, and close it when it is finished running.

4.2 Output and Report Tables from ECR® Models

The ECR03 programs generate the following Excel reports. For each ECR® and each claim type, there will be one of Scoring0-3 or no model report, depending on which modeling procedure has been selected by the program based on the sample size and the availability of the corresponding standard CIP models.

Name of Report Files	Contents
Scoring0	This report showed the summary data, including number of patients, average allowed amount, allowed amount in quartiles, etc., using typical episodes trimmed at 1 st and 99 th percentiles.
Scoring1	This report shows the risk-adjustment model using the standard CIP model coefficients. The intercept has been adjusted to neutralize the aggregated actual total amount and model predicted amount. Risk factor frequency and multiplier factors are reported.
Scoring2	This report shows the risk-adjustment model using the standard CIP model predictors and normalized to user-specific coefficients. The intercept has been adjusted to incorporate the log transformation bias. Risk factor frequency and multiplier factors are reported.
Scoring3	This report shows the user-specific risk-adjustment model built completely with user's data. The intercept has been adjusted to incorporate the log transformation bias. Risk factor frequency and multiplier factors are reported.
No model	This report shows that there is no model or predicted allowed amount being created due to small sample size. The minimum required sample size and the actual sample size are given in this report.
Full_ECR_Summary	This report shows the summary of all components, such as PAC allowance, predicted typical allowed amount, core service underuse adjustment, etc, for the full ECR calculations.
User Severity Index	This report shows the average severity index in the user's database for each ECR® with reference to the CIP population.
RF severity adjustment	This report shows the frequency of patients with 1, 2, 3, .. typical risk factors and for each risk factor category, the frequency and proportion of patients without any PACs. It also shows, for each risk factor cohort, the average PAC costs, average severity index, average severity-adjusted typical costs, average relevant costs and average PAC% after severity-adjusting typical costs.

4.3 Important SAS Data Files generated from ECR® modeling procedures

For each ECR® and each data type (i.e. inpatient stay, outpatient facility, or professional) the modeling program will create two important patient-level SAS datasets.

1. Risk-adjusted typical predicted allowed amount file (named as *<ECR name>_typical_<claim type>_pred*). This data file is generated if the minimum sample size for modeling is reached (default is 15). This data file carries over all patients and data fields from the corresponding sum typical model file. A new variable PRED_ALLOW, which is the predicted ECR® allowed amount calculated from the risk-adjustment model, is added to this file for patients within the study age range (see Appendix Table B.1 for file contents)..
2. Full ECR® price (named as *<ECR name>_fullECR*). This data file includes all patients with typical episodes. Full ECR® price and severity-adjusted typical cost are calculated for all patients within the study age range. (see Appendix Table B.2-4 for file contents).

5. Additional features and capabilities with the outputs

With appropriate data, the user can conduct additional analysis using ECR® outputs. The following sections show a few analyses that the user may be interested in.

5.1 Provider level (Attribution) analysis

The user can conduct provider level analysis, if a member-provider attribution logic has been developed. First, the user should attribute each member to the providers that hold responsibility for the member's episode. The user then can stratify the patients from the Summary file by provider, and aggregate patients' ECR® information (such as relevant, typical, PAC allowed amount) by provider to generate provider level data flow. Similarly gaps in care by provider for chronic ECRs® can be determined by linking CORE_GAP from the Core_costs file to the attributed provider file. A separate module has been created called V3.5.2 A to allow the users to run this analysis.

5.2 Regional variation analysis

If the user has patients' residential data, such as zip code, it is easy to link this information to the patients' ECR® data (the Summary file) for regional variation analysis. The user can stratify the patients from the Summary file by zip code and then aggregate patients' ECR® information (such as relevant, typical, PAC allowed amount) by zip code to generate zip code level data flow. Similar regional analysis can be conducted at county level or state level, if data is available. A regional variation analysis of care-coordination / underuse amount for Chronic care ECRs® can also be done by linking CORE_GAP from the Core_costs file to the members' zip code. A separate module has been created called V3.5.2 R to allow the users to run this analysis.

Appendix: Contents of Important SAS Data Files

Appendix A. SAS data files from ECR® construction procedures

A.1 Chronic Medical ECR® Bucket File <i>(includes IP stay, OP facility, professional, and other ancillary claims)</i>	
Variable name	Description
.....	All data fields from original STAY and PFO files
MERGE_KEY	Unique claim record identifier
CCS_*	CCS code conversion corresponding to each diagnosis and procedure code
PRCD_*	Expanded trigger protection flags
PT_AGE	Patient age at trigger (YEAR OF TRIGGER DATE-YOB)
AGE_GROUP	Patient age group. 1= (min age <= age <max age) 0=(age<min age or >= max age)
SEX	Patient Gender (M=Male F=Female)
ADMIT_EMERG	Emergency room flag
EPSD_START	Episode start date
EPSD_END	Episode end date
TRIG_START	First Date of Service of trigger
TRIG_END	Last Date of Service of trigger
EXPAND_CLM	Expanded trigger flag
EPI_LEVEL	Type of claim ('STAY'= IP stay claim 'PROF'=OP facility or professional claims)
TYPICAL_BY_EXPAND	Typical flagged by expanded triggers
HAC_BY_EXPAND	HAC STAY claims flagged by expanded triggers
PAC_BY_EXPAND	PAC flagged by expanded triggers
PAC_BY_CCSDX	PAC flagged by CCS diagnosis code
PAC_BY_CCSPX	PAC flagged by CCS procedure code
PAC_BY_EMERG	PAC flagged by emergency service
PAC_BY_WITHIN_STAY	PAC PFO claims flagged by within PAC IP stay period
FINAL_PAC	Final PAC flag
FINAL_TYPICAL	Final typical flag
BUCKET	Claim bucket ('TYPICAL'=typical claims 'PAC'=PAC claims)

A.2 Inpatient Procedural ECR® OP Bucket File <i>(includes OP facility, professional, and other ancillary claims)</i>	
Variable name	Description
.....	<i>All data fields from original PFO files</i>
MERGE_KEY	Unique claim record identifier
CCS_*	CCS code conversion corresponding to each diagnosis and procedure code
PRCD_*	Expanded trigger protection flags
PT_AGE	Patient age at trigger (YEAR OF TRIGGER DATE-YOB)
AGE_GROUP	Patient age group. 1= (min age <= age <max age) 0=(age<min age or >= max age)
SEX	Patient Gender (M=Male F=Female)
ADMIT_EMERG	Emergency room flag
EPSD_START	Episode start date
EPSD_END	Episode end date
TRIG_START	First Date of Service of trigger
TRIG_END	Last Date of Service of trigger
PACB_MOD_IP	PAC by modifier from STAY claims
PACB_MOD_OP	PAC by modifier from PFO claims
READMISSION	Readmission flag
EXPAND_CLM	Expanded trigger flag
TYPICAL_BY_EXPAND	Typical flagged by expanded triggers
HAC_BY_EXPAND	HAC flagged by expanded triggers
PAC_BY_EXPAND	PAC flagged by expanded triggers
PAC_BY_CCSDX	PAC flagged by CCS diagnosis code
PAC_BY_CCSPX	PAC flagged by CCS procedure code
PAC_BY_EMERG	PAC flagged by emergency service
PAC_BY_F_STAY_PAC	PAC flagged by within PAC IP stay period
FINAL_PAC	Final PAC flag
FINAL_TYPICAL	Final typical flag
BUCKET	Claim bucket ('TYPICAL'=typical claims 'PAC'=PAC claims)

A.3 Inpatient Procedural ECR® IP Bucket File <i>(includes IP facility stay claims)</i>	
Variable name	Description
.....	<i>All data fields from original STAY files</i>
MERGE_KEY	Unique claim record identifier
CCS_*	CCS code conversion corresponding to each diagnosis and procedure code
PRCD_*	Expanded trigger protection flags
PT_AGE	Patient age at trigger (YEAR OF TRIGGER DATE-YOB)
AGE_GROUP	Patient age group. 1= (min age <= age <max age) 0=(age<min age or >= max age)
SEX	Patient Gender (M=Male F=Female)
ADMIT_EMERG	Emergency room flag
EPSD_START	Episode start date
EPSD_END	Episode end date
TRIG_START	First Date of Service of trigger
TRIG_END	Last Date of Service of trigger
PACB_MOD_OP	PAC by modifier from PFO claims
PACB_MOD_IP	PAC by modifier from STAY claims
READMISSION	Readmission flag
EXPAND_CLM	Expanded trigger flag
TYPICAL_BY_EXPAND	Typical flagged by expanded triggers
HAC_BY_EXPAND	HAC flagged by expanded triggers
PAC_BY_EXPAND	PAC flagged by expanded triggers
PAC_BY_CCSDX	PAC flagged by CCS diagnosis code
PAC_BY_CCSPX	PAC flagged by CCS procedure code
PAC_BY_EMERG	PAC flagged by emergency service
PAC_BY_TRIG_PAC	PAC readmission flagged by trigger PAC IP stay
INDEX_STAY	Index stay flag
FINAL_PAC	Final PAC flag
FINAL_TYPICAL	Final typical flag
BUCKET	Claim bucket ('TYPICAL'=typical claims 'PAC'=PAC claims)

A.4 Inpatient Medical ECR® OP Bucket File <i>(includes OP facility, professional, and other ancillary claims)</i>	
Variable name	Description
.....	<i>All data fields from original PFO files</i>
MERGE_KEY	Unique claim record identifier
CCS_*	CCS code conversion corresponding to each diagnosis and procedure code
PRCD_*	Expanded trigger protection flags
PT_AGE	Patient age at trigger (YEAR OF TRIGGER DATE-YOB)
AGE_GROUP	Patient age group. 1= (min age <= age <max age) 0=(age<min age or >= max age)
SEX	Patient Gender (M=Male F=Female)
ADMIT_EMERG	Emergency room flag
EPSD_START	Episode start date
EPSD_END	Episode end date
TRIG_START	First Date of Service of trigger
TRIG_END	Last Date of Service of trigger
READMISSION	Readmission flag
EXPAND_CLM	Expanded trigger flag
TYPICAL_BY_EXPAND	Typical flagged by expanded triggers
HAC_BY_EXPAND	HAC flagged by expanded triggers
PAC_BY_EXPAND	PAC flagged by expanded triggers
PAC_BY_CCSDX	PAC flagged by CCS diagnosis code
PAC_BY_CCSPX	PAC flagged by CCS procedure code
PAC_BY_EMERG	PAC flagged by emergency service
PAC_BY_F_STAY_PAC	PAC PFO flagged by within PAC IP stay period
FINAL_PAC	Final PAC flag
FINAL_TYPICAL	Final typical flag
BUCKET	Claim bucket ('TYPICAL'=typical claims 'PAC'=PAC claims)

A.5 Inpatient Medical ECR® IP Bucket File <i>(includes IP facility stay claims)</i>	
Variable name	Description
.....	<i>All data fields from original STAY files</i>
MERGE_KEY	Unique claim record identifier
CCS_*	CCS code conversion corresponding to each diagnosis and procedure code
PRCD_*	Expanded trigger protection flags
PT_AGE	Patient age at trigger (YEAR OF TRIGGER DATE-YOB)
AGE_GROUP	Patient age group. 1= (min age <= age <max age) 0=(age<min age or >= max age)
SEX	Patient Gender (M=Male F=Female)
ADMIT_EMERG	Emergency room flag
EPSD_START	Episode start date
EPSD_END	Episode end date
TRIG_START	First Date of Service of trigger
TRIG_END	Last Date of Service of trigger
READMISSION	Readmission flag
EXPAND_CLM	Expanded trigger flag
TYPICAL_BY_EXPAND	Typical flagged by expanded triggers
HAC_BY_EXPAND	HAC flagged by expanded triggers
PAC_BY_EXPAND	PAC flagged by expanded triggers
PAC_BY_CCSDX	PAC flagged by CCS diagnosis code
PAC_BY_CCSPX	PAC flagged by CCS procedure code
PAC_BY_EMERG	PAC flagged by emergency service
PAC_BY_TRIG_PAC	PAC readmission flagged by trigger PAC IP stay
INDEX_STAY	Index stay flag
FINAL_PAC	Final PAC flag
FINAL_TYPICAL	Final typical flag
BUCKET	Claim bucket ('TYPICAL'=typical claims 'PAC'=PAC claims)

A.6 Outpatient Procedural ECR® OP Bucket File <i>(includes OP facility, professional, and other ancillary claims)</i>	
Variable name	Description
.....	All data fields from original PFO files
MERGE_KEY	Unique claim record identifier
CCS_*	CCS code conversion corresponding to each diagnosis and procedure code
PRCD_*	Expanded trigger protection flags
PT_AGE	Patient age at trigger (YEAR OF TRIGGER DATE-YOB)
AGE_GROUP	Patient age group. 1= (min age <= age <max age) 0=(age<min age or >= max age)
SEX	Patient Gender (M=Male F=Female)
ADMIT_EMERG	Emergency room flag
TRIG_FROM	Claim source of trigger
EPSD_START	Episode start date
EPSD_END	Episode end date
TRIG_START	First Date of Service of trigger
TRIG_END	Last Date of Service of trigger
EXPAND_CLM	Expanded trigger flag
TYPICAL_BY_EXPAND	Typical flagged by expanded triggers
HAC_BY_EXPAND	HAC flagged by expanded triggers
PAC_BY_EXPAND	PAC flagged by expanded triggers
PAC_BY_CCSDX	PAC flagged by CCS diagnosis code
PAC_BY_CCSPX	PAC flagged by CCS procedure code
PAC_BY_MOD	PAC flagged by CPT modifier code
PAC_BY_F_STAY_PAC	PAC professional claims flagged by within PAC IP stay or PAC OP facility period
INDEX_STAY	Index stay flag
INDEX_PAC	Index PAC flag
FINAL_PAC	Final PAC flag
FINAL_TYPICAL	Final typical flag
BUCKET	Claim bucket ('TYPICAL'=typical claims 'PAC'=PAC claims)

A.7 Outpatient Procedural ECR® IP Bucket File <i>(includes IP facility stay claims)</i>	
Variable name	Description
.....	<i>All data fields from original STAY files</i>
MERGE_KEY	Unique claim record identifier
CCS_*	CCS code conversion corresponding to each diagnosis and procedure code
PRCD_*	Expanded trigger protection flags
PT_AGE	Patient age at trigger (YEAR OF TRIGGER DATE-YOB)
AGE_GROUP	Patient age group. 1= (min age <= age <max age) 0=(age<min age or >= max age)
SEX	Patient Gender (M=Male F=Female)
ADMIT_EMERG	Emergency room flag
TRIG_FROM	Claim source of trigger
EPSD_START	Episode start date
EPSD_END	Episode end date
TRIG_START	First Date of Service of trigger
TRIG_END	Last Date of Service of trigger
EXPAND_CLM	Expanded trigger flag
TYPICAL_BY_EXPAND	Typical flagged by expanded triggers
HAC_BY_EXPAND	HAC flagged by expanded triggers
PAC_BY_EXPAND	PAC flagged by expanded triggers
PAC_BY_CCSDX	PAC flagged by CCS diagnosis code
PAC_BY_CCSPX	PAC flagged by CCS procedure code
PAC_BY_MOD	PAC flagged by CPT modifier
INDEX_STAY	Index stay flag
FINAL_PAC	Final PAC flag
FINAL_TYPICAL	Final typical flag
BUCKET	Claim bucket ('TYPICAL'=typical claims 'PAC'=PAC claims)

A.8 Chronic Medical ECR® Summary File	
Variable name	Description
CONSISTENT_MEMBER_ID	Unique member ID
PT_AGE	Patient age at trigger (YEAR OF TRIGGER DATE-YOB)
AGE_GROUP	Patient age group. 1= (min age <= age <max age) 0=(age<min age or >= max age)
SEX	Patient gender (M=male F=female)
GENDER	Patient gender (1=male 0=female)
TYPICAL_STAY_AMT	Typical IP stay amount
TYPICAL_PROF_AMT	Typical OP facility/professional amount
PAC_STAY_AMT	PAC IP stay amount
PAC_PROF_AMT	PAC OP facility/professional amount
RX_ALLOW_AMT_TYPICAL	Typical Rx amount
RX_ALLOW_AMT_PAC	PAC Rx amount
RLVNT_STAY_AMT	Relevant IP stay amount (=TYPICAL_STAY_AMT + PAC_STAY_AMT)
RLVNT_PROF_AMT	Relevant OP facility/professional amount (=TYPICAL_PROF_AMT + PAC_PROF_AMT)
RLVNT_RX_ALLOWED	Relevant Rx amount (=RX_ALLOW_AMT_PAC + RX_ALLOW_AMT_TYPICAL)
ALL_TYPICAL_AMT	All typical amount (=TYPICAL_STAY_AMT + TYPICAL_PROF_AMT + RX_ALLOW_AMT_TYPICAL)
ALL_PAC_AMT	All PAC amount (=PAC_STAY_AMT + PAC_PROF_AMT + RX_ALLOW_AMT_PAC)
ALL_RELEVANT_AMT	All relevant amount (=RLVNT_PROF_AMT + RLVNT_PROF_AMT)
PAC_PCNT	PAC % (All_PAC_AMT / ALL_RELEVANT_AMT)

A.9 Inpatient Procedural ECR® Summary File	
Variable name	Description
CONSISTENT_MEMBER_ID	Unique member ID
PT_AGE	Patient age at trigger (YEAR OF TRIGGER DATE-YOB)
AGE_GROUP	Patient age group. 1= (min age <= age <max age) 0=(age<min age or >= max age)
SEX	Patient gender (M=male F=female)
GENDER	Patient gender (1=male 0=female)
TYP_AMT_IP_INDEX	Typical index IP stay amount
TYP_AMT_IP_READ	Typical IP stay readmission amount
TYP_AMT_OP	Typical OP facility and professional amount
TYP_AMT_RX	Typical Rx amount
PAC_AMT_IP_INDEX	PAC index IP stay amount
IP_ADD_FAC_COSTS_DUE_TO_PAC	Additional IP facility costs due to PAC (=PAC_AMT_IP_INDEX minus health plan average TYP_AMT_IP_INDEX), if negative, made equal to zero
PAC_AMT_IP_READ	PAC IP stay readmission amount
PAC_AMT_OP	PAC OP facility and professional amount
PAC_AMT_RX	PAC Rx amount
TYP_SUM_AMT	Sum of TYP_AMT_IP_INDEX + TYP_AMT_OP + TYP_AMT_RX
PAC_SUM_AMT	Sum of PAC_AMT_IP_INDEX + PAC_AMT_OP + PAC_AMT_RX
RLVNT_STAY_AMT	Relevant IP stay amount (=TYP_AMT_IP_INDEX + TYP_AMT_IP_READ + PAC_AMT_IP_INDEX + PAC_AMT_IP_READ)
RLVNT_PROF_AMT	Relevant OP facility/professional amount (=TYP_AMT_OP + PAC_AMT_OP)
RLVNT_RX_ALLOWED	Relevant Rx amount (=TYP_AMT_RX + PAC_AMT_RX)
ALL_RELEVANT_AMT	All relevant amount (=RLVNT_STAY_AMT+ RLVNT_PROF_AMT+ RLVNT_RX_ALLOWED)
ALL_PAC_AMT	All PAC amount (=IP_ADD_FAC_COSTS_DUE_TO_PAC + PAC_AMT_IP_READ + PAC_AMT_OP + PAC_AMT_RX)
ALL_TYPICAL_AMT	All Typical amount (ALL_RELEVANT_AMT- ALL_PAC_AMT)
PAC_PCNT	PAC % (All_PAC_AMT / ALL_RELEVANT_AMT)

A.10 Inpatient Medical ECR® Summary File
Same as Inpatient Procedural ECR® Summary file

A.11 Outpatient Procedural ECR® Summary File	
Variable name	Description
CONSISTENT_MEMBER_ID	Unique member ID
PT_AGE	Patient age at trigger (YEAR OF TRIGGER DATE-YOB)
AGE_GROUP	Patient age group. 1= (min age <= age <max age) 0=(age<min age or >= max age)
SEX	Patient gender (M=male F=female)
GENDER	Patient gender (1=male 0=female)
TYP_AMT_IP_INDEX	Typical index IP stay amount
TYP_AMT_OP_INDEX	Typical index OP facility amount
TYP_AMT_IP_READ	Typical IP stay associated admission amount
TYP_AMT_OP_READ	Typical OP facility associated admission amount
TYP_AMT_PROF	Typical professional amount
TYP_AMT_RX	Typical Rx amount
PAC_AMT_IP_INDEX	PAC index IP stay amount
IP_ADD_FAC_COSTS_DUE_TO_PAC	Additional IP facility costs due to PAC (=PAC_AMT_IP_INDEX minus health plan average TYP_AMT_IP_INDEX), if negative, made equal to zero
PAC_AMT_OP_INDEX	PAC index OP facility amount
OP_ADD_FAC_COSTS_DUE_TO_PAC	Additional OP facility costs due to PAC (=PAC_AMT_OP_INDEX minus health plan average TYP_AMT_OP_INDEX), if negative, made equal to zero
PAC_AMT_IP_READ	PAC IP stay associated admission amount
PAC_AMT_OP_READ	PAC OP facility associated admission amount
PAC_AMT_PROF	PAC professional amount
PAC_AMT_RX	PAC Rx amount
TYP_SUM_AMT	Sum of TYP_AMT_IP_INDEX + TYP_AMT_OP_INDEX + TYP_AMT_PROF + TYP_AMT_RX
PAC_SUM_AMT	Sum of PAC_AMT_IP_INDEX + PAC_AMT_OP_INDEX + PAC_AMT_PROF + PAC_AMT_RX
RLVNT_STAY_AMT	Relevant IP stay amount (=TYP_AMT_IP_INDEX + TYP_AMT_IP_READ + PAC_AMT_IP_INDEX + PAC_AMT_IP_READ)
RLVNT_FACI_AMT	Relevant OP facility amount (=TYP_AMT_OP_INDEX + TYP_AMT_OP_READ + PAC_AMT_OP_INDEX + PAC_AMT_OP_READ)
RLVNT_PROF_AMT	Relevant OP professional amount (=TYP_AMT_PROF + PAC_AMT_PROF)
RLVNT_RX_ALLOWED	Relevant Rx amount (=TYP_AMT_RX + PAC_AMT_RX)
ALL_RELEVANT_AMT	All relevant amount (=RLVNT_STAY_AMT + RLVNT_FACI_AMT + RLVNT_PROF_AMT + RLVNT_RX_ALLOWED)
ALL_PAC_AMT	All PAC amount (=IP_ADD_FAC_COSTS_DUE_TO_PAC + PAC_AMT_IP_READ + OP_ADD_FAC_COSTS_DUE_TO_PAC + PAC_AMT_OP_READ + PAC_AMT_PROF + PAC_AMT_RX)
ALL_TYPICAL_AMT	All Typical amount (ALL_RELEVANT_AMT- ALL_PAC_AMT)
PAC_PCNT	PAC % (All_PAC_AMT / ALL_RELEVANT_AMT)

A.12 Sum_Model_Typical File (for all ECRs)	
Variable name	Description
.....	<i>All data fields from SUMMARY files</i>
<Typical risk factor name>	Flags for all typical risk factors related to this ECR
TYP_MODEL_AMT_(PROF/FACI/STAY)	Total typical cost for the ECR component that will be used to build risk-adjustment model.
RF_COUNT	Number of all typical risk factors (excluding age and gender)

This file only carries members that have typical claims.

Each ECR and ECR component (i.e. stay, prof, OP faci) has a separate file.

Appendix B. SAS data files from ECR® modeling procedures

B.1 Typical Pred File (for all ECRs)	
Variable name	Description
.....	<i>All data fields from SUM MODEL TYPICAL files</i>
PRED_ALLOW	Model predicted typical allowed amount
MODEL_RF_COUNT	Number of typical risk factors in the final model
PT_SEV (for prof component only)	Patient-specific severity score (Exponential of the sum product of RF and their coefficients using only typical prof model)

This file only carries members that have typical claims.

Each ECR and ECR component (i.e. stay, prof, OP faci) has a separate file.

B.2 Chronic Medical Full ECR® Price File	
Variable name	Description
CONSISTENT_MEMBER_ID	Unique member ID
PT_AGE	Patient age at trigger (YEAR OF TRIGGER DATE-YOB)
AGE_GROUP	Patient age group. 1= (min age <= age <max age) 0=(age<min age or >= max age)
SEX	Patient gender (M=male F=female)
ALL_TYP_AMT	Actual typical cost
ALL_PAC_AMT	Actual PAC cost
PRED_ALLOW	Predicted typical cost
UNDERUSE_ALLOW	Core services underuse adjustment
PAC_ALLOW	PAC allowance amount
PAC_FF_ALLOW	PAC allowance fixed amount
PAC_PAF	PAC allowance proportional factor
PAC_PROP_ALLOW	PAC allowance proportional amount
MARGIN	Margin allowance
ALL_RELEVANT_AMT	Actual total relevant cost
PRED_FULLECR	Predicted total full ECR® price
PAC_PCNT	PAC % (ALL_PAC_AMT / ALL_RELEVANT_AMT)
RF_COUNT	Number of all typical risk factors
PT_SEV	Patient-specific severity score (Exponential of the sum product of RF and their coefficients using only typical prof model)
PT_SEV_INDEX	Ratio of patient-specific severity score to the plan-average severity score
SEV_ADJ_TYP_AMT	Severity-adjusted typical amount (ALL_TYP_AMT/PT_SEV_INDEX)
SEV_ADJ_RLVNT_AMT	Severity-adjusted relevant amount (SEV_ADJ_TYP_AMT + ALL_PAC_AMT)
SEV_ADJ_PAC_PCNT	Severity-adjusted PAC % (ALL_PAC_AMT / SEV_ADJ_RLVNT_AMT)

B.3 Inpatient Procedural and Inpatient Medical Full ECR® Price File	
Variable name	Description
CONSISTENT_MEMBER_ID	Unique member ID
PT_AGE	Patient age at trigger (YEAR OF TRIGGER DATE-YOB)
AGE_GROUP	Patient age group. 1= (min age <= age <max age) 0=(age<min age or >= max age)
SEX	Patient gender (M=male F=female)
TYP_MODEL_AMT_STAY	Actual typical index IP stay cost
TYP_AMT_IP_READ	Actual typical IP readmission cost
PAC_AMT_IP_READ	Actual PAC IP readmission cost
TYP_MODEL_AMT_PROF	Actual typical professional, OP facility, and Rx cost
PAC_PROF_AMT	Actual PAC professional, OP facility, and Rx cost
PRED_ALLOW_STAY	Predicted typical index IP stay cost
PAC_ALLOW_STAY	PAC IP stay allowance amount
PAC_FF_ALLOW_STAY	PAC IP stay allowance fixed amount
PAC_PAF_STAY	PAC IP stay allowance proportional factor
PAC_PROP_ALLOW_STAY	PAC IP stay allowance proportional amount
TYP_READMIT_ALLOW_STAY	Typical IP stay readmission allowance amount
MARGIN_STAY	Margin Allowance for IP stay
PRED_ECR_STAY	Total ECR price for IP stay
PRED_ALLOW_PROF	Predicted typical professional, OP facility, and Rx cost
PAC_ALLOW_PROF	PAC allowance amount for professional, OP facility, and Rx cost
PAC_FF_ALLOW_PROF	PAC allowance fixed amount for professional, OP facility, and Rx cost
PAC_PAF_PROF	PAC allowance proportional factor for professional, OP facility, and Rx cost
PAC_PROP_ALLOW_PROF	PAC allowance proportional amount for professional, OP facility, and Rx cost
MARGIN_PROF	Margin allowance for professional, OP facility, and Rx cost
PRED_ECR_PROF	Total ECR price for professional, OP facility, and Rx cost
ALL_RELEVANT_AMT	Actual total relevant cost
PRED_FULLECR	Predicted total full ECR price
ALL_PAC_AMT	Actual total PAC costs
ALL_TYP_AMT	Actual total typical costs
PAC_PCNT	PAC % (ALL_PAC_AMT / ALL_RELEVANT_AMT)
RF_COUNT	Number of all typical risk factors
PT_SEV	Patient-specific severity score (Exponential of the sum product of RF and their coefficients using only typical prof model)
PT_SEV_INDEX	Ratio of patient-specific severity score to the plan-average severity score
SEV_ADJ_TYP_AMT	Severity-adjusted typical amount (ALL_TYP_AMT/PT_SEV_INDEX)
SEV_ADJ_RLVNT_AMT	Severity-adjusted relevant amount (SEV_ADJ_TYP_AMT + ALL_PAC_AMT)
SEV_ADJ_PAC_PCNT	Severity-adjusted PAC % (ALL_PAC_AMT / SEV_ADJ_RLVNT_AMT)

B.4 Outpatient Procedural Full ECR® Price File	
Variable name	Description
CONSISTENT_MEMBER_ID	Unique member ID
PT_AGE	Patient age at trigger (YEAR OF TRIGGER DATE-YOB)
AGE_GROUP	Patient age group. 1= (min age <= age <max age) 0=(age<min age or >= max age)
SEX	Patient gender (M=male F=female)
TYP_MODEL_AMT_STAY	Actual typical index IP stay cost
TYP_AMT_IP_READ	Actual typical IP readmission cost
PAC_AMT_IP_READ	Actual PAC IP readmission cost
TYP_MODEL_AMT_FACI	Actual typical index OP facility cost
TYP_AMT_OP_READ	Actual typical OP facility readmission cost
PAC_AMT_OP_READ	Actual PAC OP facility readmission cost
TYP_MODEL_AMT_PROF	Actual typical professional and Rx cost
PAC_PROF_AMT	Actual PAC professional and Rx cost
PRED_ALLOW_STAY	Predicted typical index IP stay cost
PAC_ALLOW_STAY	PAC IP stay allowance amount
PAC_FF_ALLOW_STAY	PAC IP stay allowance fixed amount
PAC_PAF_STAY	PAC IP stay allowance proportional factor
PAC_PROP_ALLOW_STAY	PAC IP stay allowance proportional amount
TYP_READMIT_ALLOW_STAY	Typical IP stay readmission allowance amount
MARGIN_STAY	Margin Allowance for IP stay
PRED_ECR_STAY	Total ECR price for IP stay
PRED_ALLOW_FACI	Predicted typical index OP facility cost
PAC_ALLOW_FACI	PAC OP facility allowance amount
PAC_FF_ALLOW_FACI	PAC OP facility allowance fixed amount
PAC_PAF_FACI	PAC OP facility allowance proportional factor
PAC_PROP_ALLOW_FACI	PAC OP facility allowance proportional amount
TYP_READMIT_ALLOW_FACI	Typical OP facility readmission allowance amount
MARGIN_FACI	Margin Allowance for OP facility
PRED_ECR_FACI	Total ECR price for OP facility
PRED_ALLOW_PROF	Predicted typical professional and Rx cost
PAC_ALLOW_PROF	PAC allowance amount for professional and Rx cost
PAC_FF_ALLOW_PROF	PAC allowance fixed amount for professional and Rx cost
PAC_PAF_PROF	PAC allowance proportional factor for professional and Rx cost
PAC_PROP_ALLOW_PROF	PAC allowance proportional amount for professional and Rx cost
MARGIN_PROF	Margin allowance for professional and Rx cost
PRED_ECR_PROF	Total ECR price for professional and Rx cost
ALLL_RELEVANT_AMT	Actual total relevant cost
PRED_FULLECR	Predicted total full ECR price

ALL_PAC_AMT	Actual total PAC costs
ALL_TYP_AMT	Actual total typical costs
PAC_PCNT	PAC % (ALL_PAC_AMT / ALL_RELEVANT_AMT)
RF_COUNT	Number of all typical risk factors
PT_SEV	Patient-specific severity score (Exponential of the sum product of RF and their coefficients using only typical prof model)
PT_SEV_INDEX	Ratio of patient-specific severity score to the plan-average severity score
SEV_ADJ_TYP_AMT	Severity-adjusted typical amount (ALL_TYP_AMT/PT_SEV_INDEX)
SEV_ADJ_RLVNT_AMT	Severity-adjusted relevant amount (SEV_ADJ_TYP_AMT + ALL_PAC_AMT)
SEV_ADJ_PAC_PCNT	Severity-adjusted PAC % (ALL_PAC_AMT / SEV_ADJ_RLVNT_AMT)

END OF ECR MANUAL