Chronic Condition Data Warehouse

Getting Started with CMS Medicare Administrative Research Files - A Technical Guidance Paper

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Overview

The Chronic Condition Data Warehouse (CCW) Medicare data are extracted from the Centers for Medicare & Medicaid Services (CMS) enrollment files and fee-for service (FFS) administrative claims submitted for payment to CMS. While the files were designed from the ease-of-use perspective, learning the nuances of any new data source can be challenging. Creating the appropriate analytic dataset can be the key to simplifying analysis of the data.

This document provides technical guidance to approaching Medicare enrollment and administrative data complexities and provides a framework to creating customized, analytic data files. The focus of this document is primarily Medicare enrollment, Medicare Part A, and Medicare Part B claims. In addition to narrative technical information, examples of SAS® code are shared.

Chapter 1: Contents of CCW Medicare Data Files

Medicare is the primary health insurance program for people age 65 or older, people under age 65 with disabilities, and people of all ages with End-Stage Renal Disease (ESRD). Nearly all Medicare beneficiaries receive Part A hospital insurance benefits, which helps cover inpatient hospital care, skilled nursing facility stays, home health and hospice care. Most beneficiaries also subscribe to Part B medical insurance benefits, which help to cover physician services, outpatient care, durable medical equipment (DME) and some home health care. Additionally, many beneficiaries elect to purchase Medicare Part D prescription drug coverage (available since 2006). Beneficiaries may elect to receive fee-for-service Medicare or, as an alternative, enroll in Medicare Part C (Medicare Advantage, or MA). These are private plans similar to HMOs which provide Medicare Part A and Part B services. Many plans offer prescription drug coverage options.

A. File Types

Data for 100% of Medicare-enrolled beneficiaries is available from the CCW. The CMS Institutional and Non-institutional data files found in the CCW generally represent Medicare FFS claims only (i.e., managed care encounter information is not available). A few exceptions exist, including coverage of Hospice services. The nuances of the managed care benefit are explained in greater detail in a technical publication from the Research Data Assistance Center (ResDAC) (http://www.resdac.org/Tools/tech_pubs.asp).

The Part D prescription drug events (PDEs) data represent events from all beneficiaries participating in the Part D program, regardless of whether the beneficiary is enrolled in managed care or a FFS plan. PDEs are available for all prescription fills that are covered as part of the Part D benefit from 2006 forward (the inception of the benefit), whereas claims data are available from 1999 forward.

Beneficiary Summary File

The Beneficiary Summary File is created annually and contains demographic and enrollment data for all beneficiaries who are alive and enrolled in Medicare for any part of the year. This annual person-level summary file can be used to determine whether a beneficiary has a sufficient surveillance period (i.e., months of enrollment in the Medicare benefit) for inclusion in the analytic file being created. Variables contained in this file include: 1) the number of months of Medicare Part A, B, C, and D coverage; 2) whether the beneficiary died during the year; 3) Part D plan type (if applicable); 4) whether the beneficiary received Part D subsidies; and, 5) other beneficiary demographic and geographic information.

Beneficiary Annual Summary File (BASF)

The BASF contains most of the demographic and enrollment information from the Beneficiary Summary File. In addition, the BASF contains metropolitan status (e.g., whether living in Core Based Statistical Area or Metropolitan Statistical Area, depending on the year of the file), number of months enrolled in both Parts A and B (these are separate variables in the Beneficiary Summary File), and clinical condition categories. The BASF contains summarized treatment information for all beneficiaries in the file. This file includes two variables for each of the existing 21 CCW chronic conditions: 1) a yearly indicator, which specifies whether each of the 21 chronic condition definitions was met during the respective time period ending December 31, YYYY; and, 2) a first occurrence date, which indicates the date the beneficiary was first identified as having met the specifications for the condition (note: 1999 is the earliest year that will appear in this field). These chronic condition fields are defined using an algorithm that examines a pattern of medical care utilization, as determined by Medicare FFS claims. See (http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories.pdf) for the specifications for the 21 conditions (note: the 21 chronic condition information was previously delivered as the Chronic Condition Summary File, also known as the CC Summary).

This file is available in the current layout for 1999 forward.

B. Claim Types

In general, all CMS administrative data files contain key variables which can be used to join the CCW files (e.g., BENE_ID, CLM_ID, CLM_LINE_NUM, etc.). The linkage keys used may vary depending on which files you are attempting to join. For example, some will link different portions of a claim together by using the claim identification number and claim line number (CLM_ID, CLM_LINE_NUM). When medical services provided to a beneficiary are the focus, the primary linkage will be at the person level (i.e., the BENE_ID), after aggregation of the claim level files.

Medicare Institutional Claims

The claims from institutional providers and/or settings which are covered by the Medicare Part A benefit, appear in the Institutional claims file. In addition, claims for institutional-based services covered by the Medicare Part B benefit (e.g., home health, hospital outpatient) appear in the Institutional claims file. Providers use the UB-04 claim form (also known as CMS 1450) to submit claims to CMS. Part A claims are processed by CMS contractors known as Medicare Administrative Contractors (MAC), formerly known as Fiscal Intermediaries (FI). For each setting, there is a base file and a revenue center file, which are explained in greater detail in section "C. Claim Structure" below. More information regarding the contents and processing of these claim forms is available on the CMS website (http://www.cms.gov/ElectronicBillingEDITrans/15_1450.asp). These files include the following types of claims:

- **Inpatient -** This is the base file (i.e., the core record for the inpatient claim) with final action claims data – that is, a version of the claim record that reflects services billed by the inpatient hospital for facility costs, processed by the MAC, resubmitted and corrected if necessary, and finalized. Sufficient time must pass before the claims files are considered mature and complete or "final action". This file includes ICD-9 diagnosis and procedure codes, Diagnosis Related Group (DRG) information, dates of service, reimbursement amount, hospital provider, and beneficiary demographic information. Each record in this file is at the claim level.

- **Outpatient -** This is the base file with final action claims data for outpatient services submitted by institutional outpatient providers (e.g., hospital outpatient departments, Rural Health Centers [RHCs], Federally Qualified Health Centers [FQHCs], renal dialysis facilities, outpatient rehabilitation facilities, comprehensive outpatient rehabilitation facilities, and community mental health centers). This file includes ICD-9 diagnosis codes, CMS Common Procedure Coding System (HCPCS) codes, dates of service, reimbursement amount, outpatient provider number, and revenue center codes. Each record in this file is at the claim level.
- **Skilled Nursing Facility (SNF)** - This is the base file with final action claims data for claims submitted by SNF providers. This file includes ICD-9 diagnosis codes, dates of service, reimbursement amount, and SNF provider number. Each record in this file is at the claim level.
- **Hospice -** This is the hospice services base file for final action claims submitted by hospice providers. This file includes the level of hospice care received (e.g., routine home care, inpatient respite care), terminal diagnosis (ICD-9 diagnosis), dates of service, reimbursement amount, and hospice provider number. Note that claims for all beneficiaries receiving hospice services appear in this file – even hospice services provided to beneficiaries enrolled in managed care plans. Each record in this file is at the claim level.
- **Home Health Agency (HHA) -** This is the HHA services base file for final action claims submitted by HHA providers. This file includes the number of visits, type of visit (e.g., skilled-nursing care, home health aides, physical therapy, speech therapy, occupational therapy, and medical social services), diagnosis (ICD-9 diagnosis), date(s) of visit(s), reimbursement amount, and HHA provider number. Each record in this file is at the claim level.

Medicare Non-Institutional Claims

The Medicare Non-Institutional claims include services covered by the Part B benefit, and consist largely of professional services and DME. Providers use the CMS 1500 claim form to submit bills for services rendered to CMS. All claims are processed by Medicare Administrative Contractors (MACs; previously known as Carriers). More information regarding the contents and processing of these claim forms is available on the CMS website (http://www.cms.gov/ElectronicBillingEDITrans/16_1500.asp#TopOfPage). These files include the following types of claims:

- **Carrier** - This is the base or main file containing final action claims data for Non-Institutional providers (e.g., physicians, physician assistants, clinical social workers, nurse practitioners, independent clinical laboratories, ambulance providers, and free-standing ambulatory surgical centers) processed by MACs (note: the old file name was physician/supplier). This file includes ICD-9 diagnosis codes, HCPCS codes, dates of service, reimbursement amount, and non-institutional provider numbers (e.g., UPIN, PIN, NPI). Each record in this file is at the claim level.
- **Durable Medical Equipment (DME) -** These are the Non-Institutional claims for the Durable Medical Equipment Regional Carrier [DMERC] base file containing final action claims submitted by DME suppliers and providers. This file includes ICD-9 diagnosis codes, HCPCS codes, dates of service, reimbursement amount, and DME provider number (i.e., supplier number, NPI). Each record in this file is at the claim level.

Medicare Prescription Drug Event Files

For Part D prescription drug events, one record represents a unique event, which is a single prescription drug fill. Prescription drug fills do not consist of a uniform quantity of medication; rather, the days supply of the medication may be quite variable. For example, fills for the same medication may be for a one week supply or a three month supply. The file includes specific information regarding the drug (i.e., the national drug code, or NDC) and the quantity dispensed. More information regarding the contents and processing of these services is available on the CMS website (http://www.cms.gov/DrugCoverageClaimsData/). In addition, a technical guidance paper entitled *Technical Guidance for Researchers Summarizing and Describing Prescription Drug Utilization* is available on the CCW website (http://www.ccwdata.org/cs/groups/public/documents/document/ccw_part_d_tech_guidance.pdf).

Note that some drugs are covered under the Medicare Part B benefit, and appear in the Non-Institutional claims file rather than the Part D event file. The Part B covered drugs are generally injectable or infused drugs administered in a medical setting (e.g., chemotherapy and some vaccines).

C. Claim Structure

The claims data files vary in structure, depending on the claim type (see ccwdata.org for file record layouts and definitions). One claim type may consist of multiple related files.

Structure of Medicare Institutional Claims

For Institutional claims, the ***base file*** contains the base claim record, while the ***revenue center file*** contains potentially multiple revenue center records for a corresponding base claim record.

- **Base File -** This file contains claim header information such as claim ID, beneficiary ID, claim type, claim from date, claim through date, weekly processing date, provider ID, claim level payment amount, pass through per diem amount, claim total charge amount, admitting diagnosis, primary diagnosis, and up to ten additional diagnosis code fields and six procedure codes with associated dates, as well as the DRG. Note that beginning with claims files from 2009, the claims (version J of the layout) allow for 25 diagnosis codes and 25 procedure codes.
- **Revenue Center File** - This file contains the line level procedures (HCPCs) for the claim. Revenue center fields include the claim line number, claim type, DRG, HCPCS, Revenue Center code, Revenue Center date, rendering physician ID, revenue center unit count, revenue

center charge amount, and revenue center payment amount. Note that the revenue center payments are totaled and reflected on the base file, therefore most data users will not use the revenue center payment information. Reference the "Medicare Fee-For-Service Institutional Claim" file layout on http://www.ccwdata.org/data-dictionaries/index.htm for more detail.

- You may only need to use the base file, however, if you are interested in more detailed cost and procedure information you will benefit from the revenue center detail. The revenue centers represent institutional cost centers, for which separate charges are billed. For example, there are revenue centers for emergency department (ED), intensive care, physical therapy, laboratory, pharmacy, blood, imaging, etc. It is common to use the revenue center detail if you are interested in the Outpatient file because the revenue center contains important information to help distinguish between care settings (e.g., clinic vs. dialysis care). Additional information regarding how to use the revenue center information to distinguish between types of outpatient services is presented in Chapter 2.B., below. The base and revenue center file records for a claim are linked using the claim ID (CLM_ID), and the revenue center lines are numbered sequentially using the claim line number (CLM_LINE_NUM).
- Additionally, four types of reference code files are available to link to the base claim, including condition, occurrence, span, and value code files. These files are rarely used; however, they contain information regarding special conditions which may affect payer processing. For example, for inpatient claims, the operating Indirect Medical Education (IME) Amount and the operating Disproportionate Share (DSH) Amount fields are derived using the Value codes reference file. These are important to understand if you are examining geographic variation in payment amounts or variation by facility type. See Table 1 for more detail on Reference Code files.

Table 1: Reference Code files

File Name	Description
Condition codes	Codes that indicate a condition relating to an Institutional claim (e.g., insurance related, special condition, student status, accommodation, CHAMPUS, SNF, etc.). Information in the Condition Code File may help identify outlier payment situations (e.g., disproportionate share).
Occurrence codes	Codes that identify a significant event/date relating to an Institutional claim (e.g., accident, medical condition, insurance related, service related, etc.). The corresponding date of the occurrence is listed.
Span codes	Codes that relate to an institution (e.g., exhausted all full/coinsurance days but covered on cost report, hospital prior stay dates, visits occurring in this billing period if different, etc.). The from and through dates during which the situation indicated in the span code are given.
Value codes	Codes indicating value of a monetary condition used by the intermediary to process an Institutional claim (e.g., the wage index to be applied to home health care due to the beneficiary location). The amount indicated by the value code is given.

The ResDAC website has additional information about these Reference Code files, including tables which indicate valid values. Refer to the Institutional file layout (http://www.resdac.org/ddvh/dd_via2.asp).

Structure of Medicare Non-Institutional Claims

A claim in the ***base file*** corresponds to potentially multiple associated line item records in the ***line file***.

- **Base file** - This file contains the overall claim level information such as the claim ID, beneficiary ID, claim type, referring physician, claim from date, claim through date, claim processing date, carrier number, claim payment amount, claim allowed charge amount, and up to eight diagnosis codes. Note that beginning with claims files from 2009, the claims (version J of the layout) allow for 12 diagnosis codes.
- **Line file -** This file contains the individual line level information from the claim. This includes the HCPCS code(s), diagnosis code(s), first and last expense dates, line allowed charge amount, line submitted charge amount, and performing provider identifier.

  It is common to find the line item detail helpful. For example, if looking for procedures (e.g., immunizations, tests, or other treatments) or for all providers who had a role in caring for the patient, the line files are important. The base and line files for a claim are linked using the Claim ID (CLM_ID), and there may be more than one line file for a claim which is indicated by the claim line number (LINE_NUM).

Structure of Medicare Part D Events

For Medicare Part D prescription drug events (PDEs), each record represents a unique drug fill. In other words, the drug has been dispensed at the pharmacy. The PDEs are final action, and the event contains all of the information available at the time of the fill. No additional linkage or processing of the PDE data is necessary to be able to use these Part D files.

D. Receiving CCW Data

Data files are shipped to you on either a USB external hard drive or a DVD/CD. These data files are packaged as encrypted self-decrypting archive (SDA) files (see the CCW User Guide at ccwdata.org for additional information on encryption). The decryption password is sent to you electronically via email. When you receive the data package (via hard drive or DVD/CD), copy them from the shipping media to your local workspace. Note some data shipped on a hard drive can be decrypted on that hard drive, depending on the size of the data files. Using the password provided to you via email, follow the Decryption Instructions enclosed in the data package. Each SDA contains the data file(s), SAS® code and a file transfer summary (.fts) file which can be used to verify the data was read in correctly.

Chapter 2: Methods

This chapter describes methods used with the standard record layout (see ccwdata.org) for Medicare data files that are compiled and delivered by CCW to end users. Although the variable names and values are generally consistent over time, you may need to make slight modifications (e.g., with onset of Part D data in 2006 additional data became available).

It is possible that for a given study, several smaller analytical files may be desirable in order to easily manipulate the data for the desired results.

A. Sample Selection

You have likely received either the Beneficiary Summary File or BASF, both of which include Medicare enrollment and coverage information for all beneficiaries in your study population. There is a single row of data for each beneficiary. It will be important to determine whether you may need to subset this population for your purposes. For example, you may want to limit your data to the subsample with sufficient FFS coverage to allow for adequate surveillance (opportunity to observe FFS claims). Similarly, some treatment patterns may be more accurately assessed only for people of a certain age, or for males or females.

Length of Enrollment in the Medicare Benefit

From the universe of beneficiaries included in your data file, you may wish to reduce the population to those who are "at risk" for the events of interest. Not all Medicare beneficiaries are enrolled in FFS Medicare; however, these are the only types of claims that appear in the Medicare data files (note that in a few exceptions, claims for managed care enrollees will appear, for example with hospice claims). More information about claims data for managed care enrollees is available in a ResDAC technical publication at http://www.resdac.org/Tools/tech_pubs.asp

For Medicare Part D data, however, all covered prescription drug fills are present, regardless of whether the beneficiary is enrolled in FFS (known as a stand-alone Prescription Drug Plan [PDP]) or managed care (known as a Medicare Advantage – Part D Plan [MA-PD]). You will need to determine if the analysis should only include those persons with FFS coverage, or a certain minimum amount of FFS coverage, during the time frame of interest.

There may be times when it is appropriate to exclude someone from your sample if the subject died during the surveillance period – and other times when it is important to capture death as an outcome. Note that the death variable in the Medicare data files only indicates deaths which occurred the year of the data file; a death occurring after the end of the calendar year of the file is not noted. You should be cautious when requiring a certain length of Medicare coverage, because coverage is terminated after death. For example, if you were studying acute myocardial infarction (AMI) and wanted to examine cases for 2009, your denominator (beneficiary sample) should be restricted to those who had at least some Part A coverage (for FFS payment of the inpatient stay), but if you require a full 12 months of coverage you will lose your subjects who did not survive the AMI. Best practice would be to include beneficiaries who had Part A coverage for each month of the study year that they were alive.

For more information about applying coverage restrictions, please refer to a previous Technical Guidance paper on the CCW website (http://www.ccwdata.org/analytic-guidance/index.htm). Sample code for selecting a sample based on Medicare coverage appears later in this section of the paper.

Type of Medicare Coverage

Do you need to be able to observe treatment/receipt of care or to accurately ascertain diagnoses and comorbid conditions? If so, you may wish to select beneficiaries who had FFS Medicare A and B coverage. Those enrolled in Medicare Part C have managed care coverage, and the transactional data regarding services received are not included in the claims data files. The Beneficiary Summary File indicates the type of Medicare coverage obtained.

The Beneficiary Summary File also indicates whether the person was dually eligible for both Medicare and Medicaid services. The Medicare state buy-in variable appears 12 times in both of the annual Beneficiary Files to represent each month of coverage. The values within this variable indicate whether the beneficiary had Medicare Part A and/or B coverage for the month, and whether there was state buy-in (i.e., Medicaid) for the Part B premium. A limitation of this state buy-in variable is that it does not provide information regarding whether the beneficiary was entitled to full or only partial Medicaid benefits. There is also a summary variable which counts the months of state buy-in. In 2006, an additional variable describing dual eligibility became available. This is the Medicaid Dual Eligible Months variable (DUAL_ELGBL_MOS_NUM), which describes the extent of the Medicaid subsidy in a bit more detail (e.g., some may have subsidized Part B coverage only - or Part D coverage only).

See Table 2 for the variable names of interest.

Table 2: Variable names for variables with monthly values

Variables with monthly values	**SAS® Variable name(s)** *The last 2 digits are sequential 01-12*
Medicare buy-in indicator	BENE_MDCR_ENTLMT_BUYIN_IND_xx
HMO indicator	BENE_HMO_IND_xx

Age or other Demographic Information

The Medicare program is the primary health insurance program for people age 65 or older. The majority of older adults are enrolled in Medicare; therefore the Medicare data are often used for inferences regarding medical care for older adults in the U.S. The program also provides insurance coverage for people under age 65 with certain disabilities, and people of all ages with ESRD. The beneficiary population enrolled in Medicare who is under age 65 differs from the general Medicare population and the general U.S. population in ways that are important to consider when selecting a sample for study.

If the objective is to understand medical care provided to all people with Medicare FFS coverage, it may be appropriate to retain all ages in your sample. However, if your objective is to calculate rates for certain metrics, it may be desirable to limit the sample to specific age groups (e.g., those aged 65 or older either at the end of the calendar year, at time of event, or at the time of death, if it occurred during the year of interest). There are additional considerations when using Medicare data for population statistics, such as person-time of enrollment in FFS Medicare, which are more thoroughly discussed in a separate Technical Guidance paper on the CCW website (http://www.ccwdata.org/cs/groups/public/documents/document/ccw_techguideresearchers.pdf).

Aggregating Data to Summarize Coverage Variables

A description of the variables included within the Beneficiary Summary File can be found in the *Type of Medicare Coverage* section on the previous page. Using these variables, it is relatively simple to obtain denominator counts which take into consideration the number of beneficiaries who EVER had Part A or B coverage, managed care coverage, or dual coverage during the year. Note that, on a rare occasion, these monthly counts may exceed the number of months the beneficiary was alive during the year. That is, if a beneficiary died during the year, occasionally the months of coverage will exceed the months the beneficiary was alive. If precision is important, it is advisable that you truncate coverage at the month of death (or month prior to month of death). A code example is shared below.

Code example 1: Define a sample of Medicare fee-for-service (FFS) beneficiaries with FFS coverage.

Define a sample of Medicare FFS beneficiaries with a specified duration of A and B FFS coverage, or coverage until the month of death. The first portion of the code uses the monthly coverage variables to require at least 11 months of FFS coverage; the second portion of code demonstrates how the summary variables, which count the number of covered months, can be used. Coverage for Medicare Part D is considered in the third portion of this code. The input data source is the Beneficiary Summary File from 2009 (note: the variables and variable names are generally the same over time, with the exception of the new Part D data in 2006).

> The following SAS® code assumes that you are developing a new data file (called ***coverage***) by using Medicare coverage specifications. Then you may use these variables to subset your population (e.g., FFS only).

```
data coverage (keep=bene_id bene_sex_ident_cd rti_race_cd
      bene_age_at_end_ref_yr member_Mos cov09 ffs09 ptd09 dual_flag mdcd09
      bene_death_dt);
set a.beneficiary_ABD_file;

/*Determine Medicare Part A and B Full Fee for Service Coverage*/
/*coverage using monthly variables*/

array MemberMos_AB (12) bene_mdcr_entlmt_buyin_ind_01 -
bene_mdcr_entlmt_buyin_ind_12;
array MemberMos_noHMO (12) bene_hmo_ind_01 - bene_hmo_ind_12;
array Member_FFSMos (12) Member_FFSMos01 - Member_FFSMos12;

do i= 1 to 12;
      if MemberMos_AB(i) in ('3','C') and MemberMos_noHMO(i)in('0','4')then
      Member_FFSMos(i)=1;
      else if MemberMos_AB(i) NOT in('3','C') or MemberMos_noHMO(i)NOT
      in('0','4')then Member_FFSMos(i)=0;
      Member_Mos=sum(of Member_FFSMos:);
end;

if (bene_death_dt=. and Member_Mos in (11,12)) or (bene_death_dt~=.
      and month(bene_death_dt) = Member_Mos and   Member_mos~=0) then
      Cov09=1;
else Cov09=0;

/*coverage using summary variables*/

if bene_hmo_cvrage_tot_mons=0 and ((year(bene_death_dt)~=2009 and
bene_hi_cvrage_tot_mons=12 and bene_smi_cvrage_tot_mons=12) or
(year(bene_death_dt)=2009 and bene_hi_cvrage_tot_mons=month(bene_death_dt)
and bene_smi_cvrage_tot_mons=month(bene_death_dt))) then
ffs09='Y';
else ffs09='N';

/*Part D coverage */

if ((year(bene_death_dt)~=2009 and plan_cvrg_mos_num=12 ) or
```

```
(year(bene_death_dt)=2009 and plan_cvrg_mos_num=month(bene_death_dt))) then
ptd09='Y';
else ptd09='N';

label
      Cov09= '11 or 12 months FFS no HMO - except for those who died'
      Member_Mos = 'Total Member months of A B and No HMO - per bene'
      ffs09 = '12 months of Part A&B FFS-no HMO, or until death month'
      ptd09 = '12 months of Part D coverage, or until death month';
run;

proc freq data= coverage;
    where ffs09='Y';
    tables  ptd09 rti_race_cd bene_sex_ident_cd;
      title'demographic description of full FFS population';
run;
```

Another option for evaluating FFS is found below. This Proc freq does not limit to FFS = Yes but does cross tabulations for each variable, using FFS.

```
proc freq data= coverage;
    tables  ptd09*ffs09 rti_race_cd*ffs09 bene_sex_ident_cd*ffs09;
      title'demographic description of full compared to non-full FFS
population';
run;
```

With a few minor changes you can easily modify this SAS® code to fit your own denominator specifications (e.g., two-month break in coverage; not requiring Part B coverage; only Part A coverage). As of 2006, information regarding Part D coverage is available.

It may be desirable to require full or partial Part D coverage if you wish to examine Part D event data (e.g., BENE_PTD_PLAN_TOT_MONS ='11' or BENE_PTD_PLAN_TOT_MONS ='12').

This level of detail may be important for those studying the effect of plan changes during the year, or service use for partial years; however researchers who are not studying these issues in-depth may wish to generalize the monthly coverage information. For example, it may be sufficient to select a sample based on having coverage for the full year (or until time of death). Analysts may select variables from the Beneficiary Summary File as key study variables of interest, such as whether the beneficiary was dually enrolled in both Medicare and Medicaid. For others, a more summarized version of this information may suffice (e.g., knowing that the beneficiary was dually eligible for at least one month of the year).

Options for summarizing beneficiary coverage information are described more thoroughly in a separate Technical Guidance paper on the CCW website (http://www.ccwdata.org/cs/groups/public/documents/document/ccw_techguideresearchers.pdf).

The Beneficiary Summary Files contain a few variables which summarize the number of months of particular types of coverage for each beneficiary during the year. See Table 3 below for the relevant variable names.

Table 3: Variable Names for variables related to months of eligibility

Variables which count # months of eligibility	SAS® Variable name(s)
Months of health insurance (Medicare Part A) coverage	BENE_HI_CVRAGE_TOT_MONS
Months of Part B coverage	BENE_SMI_CVRAGE_TOT_MONS
Months of Part D coverage*	PLAN_CVRG_MOS_NUM
Months of state buy-in for Medicaid/Medicare dual eligibles	BENE_STATE_BUYIN_TOT_MONS
Months of managed care coverage	BENE_HMO_CVRAGE_TOT_MONS
Months of Medicaid dual eligibility*	DUAL_ELGBL_MOS_NUM

* Months of Part D coverage variable (and other Part D variables) available 2006 forward.

Once you have selected a sample based on the parameters of interest, decide whether you want to keep all of the variables in this file as some may not be of interest for your study. Note: that the data file can become very wide if you are intending to merge multiple years of data, or information regarding utilization from Medicare claims data files.

B. Examining Patterns of Health Care Utilization

After you have selected your sample, the next step is to obtain the subset of claims data that is relevant for your analysis. It is important to understand which claims files to use for particular purposes.

Note: not all Medicare enrolled beneficiaries will have used Medicare-paid services in a particular time frame. Some do not use any medical services at all, while others may use services that are paid by a third party (e.g., the Veteran's Administration). Third party claims do not appear in the Medicare data files.

Selecting Utilization Data Files

The files are partitioned into payment types and a variety of different payment rules and processes apply in different care settings. Since each of the claims files contains a large number of variables, we recommend extracting only the required variables and observations for your analysis.

There are some types of services where it may be possible to observe either an Institutional or Non-Institutional claim, or both claim types for a service. In general, the professional component of a service (e.g., the physician or therapist care, etc.) appears in the Non-Institutional file (i.e., Part B Carrier), whereas the facility claim for an associated service, when applicable, appears in the Institutional file (e.g., Part A Inpatient or SNF).

One of the most common examples of a type of service which may appear in either the Institutional or Non-Institutional claims is outpatient clinic-type services for physician or other provider care. If the objective is to understand the ambulatory care provided to a patient (e.g., a physician/clinic visit for a service), the hospital outpatient file, which includes hospital-based clinics, RHCs, and FQHCs, should be examined in addition to the Part B Carrier files.

Another common example of a service which may appear on an Institutional or Non-Institutional claim is a surgical procedure, which can be performed on an outpatient basis. Institutional facilities (e.g., hospitals) submit bills using a Part A (Institutional) claim, and free-standing ambulatory surgery centers (ASCs) submit Part B (Non-Institutional Carrier) claims. The professional component of these services (e.g., surgeon and anesthesiologist) for all settings will appear on the Part B Carrier claim.

Extracting Utilization Information from Claims

You have many options for exploring and describing utilization. Numerous variables in the claims files make it possible to classify the types of services received (i.e., care setting and procedures), and the reason (i.e., diagnosis) for the care. There are also many options for the unit of analysis (e.g., number of visits, total hospitalized days, per capita utilization).

The Medicare claims files are very large. It will be important to determine whether you need to include all claims for your sample, regardless of the reason for the medical care, or whether you may be able to satisfy your analytic objectives by querying the data files and extracting only the claims related to receipt of specific types of care, or care for certain conditions.

Some beneficiaries will not have any utilization (claims) data, whereas other beneficiaries will have a very large volume of services. There are several steps which must be taken to accurately organize utilization: 1) Verify you are examining utilization for the appropriate claim type (Institutional, Non-Institutional, or both); 2) Determine the care setting(s) you need to examine within the Institutional/Non-Institutional claims; and, 3) Determine whether you need to explore all care for your sample or look only for certain types of care (i.e., diagnoses, procedures, or any care within a particular setting/level of care).

The information important to your objectives may be located on the base portion of the claim or in the revenue center file (for Part A – Institutional claims) or the line file (for Part B – Non-Institutional claims). Refer to previous section: 1.C. Claim Structure. For some research questions, there may be more than one methodology which could be used to address a question. For example, there are numerous ways that Medicare claims could be classified, and our intention is not to be prescriptive, but rather to demonstrate one method which may be helpful in beginning to examine Medicare administrative data files.

- **Utilization from Institutional Claims** - Institutional claims cover a variety of setting types, some of which are classified as Inpatient, while others are Outpatient.

  Often the entire inpatient stay will be included on a single claim; however, this is not always the case, particularly for lengthy stays. To be certain you have captured all of the claims associated with a stay, we suggest the following process:
    - Begin by sorting the claims by type (e.g., all acute inpatient claims together, all critical access hospital [CAH] claims together), person (BENE_ID), claim from date (CLM_FROM_DT) and claim through date (CLM_THRU_DT).
    - An individual stay may be determined by sorting all claims for a beneficiary within a type of service by descending first service date, last service date, and claim ID. Note that acute inpatient services, which is often the type of care one might wish to query if looking for reasons for inpatient care, may consist of both inpatient acute hospitalizations as well as hospitalizations in a critical access hospital; however, inpatient care in other settings (e.g., inpatient rehabilitation or long term hospitals) may not be desirable to

include for this purpose. Refer to Table 4 (below) for an illustration of how to identify the different inpatient settings.

- A new stay may be identified as a record with a missing discharge date that is not a transfer and is not the same as the previous discharge date in the ordered claims. Note that many beneficiaries are not discharged to home after an inpatient stay – rather they continue to use some sort of institutional or community-based post-acute care. A discharge status code of 30 indicates they are "Still a Patient."

Some important variables to consider for classification of services for Institutional claims are described below.

- Claim type – This is the variable on the base claim record that describes the type of claim that was processed (NCH_CLM_TYPE_CD). The data dictionary describes the values (e.g., inpatient, outpatient, SNF, swing bed, hospice, physician encounter, etc.).
- Facility type (CLM_FAC_TYPE_CD) – This can be used to identify the type of facility that provided care to the beneficiary. Categories include hospital, SNF, HHA, Intermediate Care unit [IMC], ASC, etc.).
- Type of service (CLM_SRVC_CLSFCTN_TYPE_CD) – This can be used to specify the type of service provided to the beneficiary and is used in combination with facility type. This code can be used to help identify rural and FQHCs as well as ambulatory surgical centers.
- Provider Number (PRVDR_NUM) – The first two digits of a provider number can be used to identify the provider state. The third and fourth digits identify the type of facility. This can be used in combination with a specific claim type to identify payment settings.
- RHCs and FQHCs – These facilities can be identified using the claim facility type code (CLM_FAC_TYPE_CD) and claim service classification code (CLM_SRVC_CLSFCTN_TYPE_CD) in Institutional claims (Outpatient file). Another method for identifying RHCs and FQHCs is to use the last 4 digits of the Provider Number (PRVDR_NUM).
- Revenue Center (REV_CNTR_CD) – This identifies the cost center within a hospital or facility where the service was provided. This can be used to identify services delivered in the ED, ICU, and IMC. Note that this information can be obtained from the revenue center file, rather than the Institutional base claim file.

Some care types which appear in Institutional claims and could be billed in more than one way are presented below:

- **Emergency Department Care Utilization** - The Revenue Center Files associated with an Institutional claim must be examined to determine whether ED services were received. There are two methods for billing for these services, depending on whether or not the beneficiary was admitted to the hospital. The Inpatient revenue center should be used to identify ED services where the beneficiary was subsequently admitted to the hospital, otherwise the Outpatient revenue center will identify beneficiaries who were discharged from the ED. Often a single ED visit will have bills for both the facility and the provider caring for the patient.

- ➢ Hospital outpatient and Acute Inpatient ED claims are identified by revenue center codes equal to '0450','0451','0452','0456', '0459'.
- ➢ In addition to the ED (facility) codes listed previously, there may be a bill for the professional component of the ED service. The professional component of the ED care can be identified by revenue center code0981. In addition, the professional component of an ED visit may be identified in the Part B Carrier claims as BETOS code 'M3'. BETOS codes are derived from the individual HCPCS code on the claim (see the following section on "Utilization from Non-Institutional Claims" for more details regarding BETOS codes).
- ➢ A SAS® code example for how to identify ED claims appears below in code example 6.

- **Utilization from Non-Institutional Claims** – Non-Institutional claims cover a variety of settings including physician office, laboratory, imaging, procedures, ambulatory surgery, and others. Some important variables to consider for classification of services as ambulatory or Physician Office claims are described below.
  - o Place of service (LINE_PLACE_OF_SRVC_CD) – This is the Part B (Non-Institutional claim) line item code (i.e., on the line file rather than the Part B base file) indicating the location where the service was provided.
  - o Type of service (LINE_CMS_TYPE_SRVC_CD) – This is the Part B line item code indicating the type of service (e.g., medical care, surgery, ambulatory surgical center, etc.).
  - o Berenson-Eggers Type of Service (BETOS) codes – This is a reference data set using the CMS HCPCS procedure codes to classify the types of care received. BETOS codes are clinically understood categories that can be used for analysis of patient care. A cross-walk of HCPCS code to BETOS code can be downloaded from the CMS website (http://www.cms.gov/HCPCSReleaseCodeSets/20_BETOS.asp). These codes allow data users to distinguish between care provided by physicians and other types of services.
    - ➢ For example: Claims with BETOS codes of D1A, D1B, D1C, D1D, D1E, D1F, and O1C are identified as DME claims. BETOS code D1G indicates DME drug utilization.

- **Utilization from both Institutional and Non-Institutional Claims –**There are some types of medical utilization which may appear in both Institutional and Non-Institutional claims files. Two scenarios are illustrated below.
  - o **Outpatient Physician Care** – Visits with health care professionals in the ambulatory setting may take place in an outpatient facility or a provider office setting.
    - ➢ Outpatient care is identified from the Institutional Outpatient claims files. Revenue Center Codes (found on the Revenue Center File) are used to identify the nature of care (e.g., RHC, FQHC). A revenue center code table can be found on the ResDAC website (http://www.resdac.org/ddvh/Version_J_Tables/REV_CNTR_TB.htm). Alternatively, you may identify the CPT codes used to bill for the types of visits of interest (e.g., 99201-99205, 99211-99215 are used for office care for new or

established patients). BETOS codes, described below, may also be referenced to obtain the HCPCS codes of interest.

- Physician Office Care, is a small portion of the claims found in the Part B Carrier files. If you are interested in examining particular types of services, such as face-to-face visits with providers (also referred to as evaluation and management services), you must employ different procedures for two different claim types (i.e., the hospital outpatient/clinic and the provider office). Both the Outpatient Revenue Center file and the Part B Carrier claims file should be used . Some classification examples are shown below, in Table 4.
  - For the Part B Carrier claims, identify the relevant BETOS codes, which are cross-walked to the appropriate HCPCS codes. The BETOS_CD data file is located in the Carrier Line item files (not the base files). BETOS codes can be downloaded from the CMS website (http://www.cms.gov/HCPCSReleaseCodeSets/20_BETOS.asp).

- **Some drugs** are covered under the Medicare Part B benefit - such as intravenous chemotherapy, other infused drugs, and some vaccines. These services may be found using the HCPCS on the revenue center file for Institutional claims, or on the line file for Non-Institutional claims (e.g., many chemotherapy drugs are found in HCPCS J9000-J9999; pneumococcal vaccine may use HCPCS 90669, 90670 or 90732, depending on age of patient and the particular vaccine).

Table 4 below displays algorithms which may be helpful in categorizing services from both Institutional and (Non-Institutional claims.

Table 4: Algorithms for Use in Categorizing Institutional and Non-Institutional Claims

Setting	Claim Type	Selection Criteria
Part A Institutional Claims (note: Inpatient, SNF, HHA, Hospice, and Outpatient are in separate files)		
Acute Hospital	**Inpatient Base** NCH_CLM_TYPE_CD = 60, 61	Substr(PRVDR_NUM,3,1) =' 0'
	Inpatient Revenue Center File: ED *Intensive Care Unit* *Intermediate Care Unit* *Critical Care Unit*	The base claim record links with a revenue center record as follow: If REV_CNTR in ('0450','0451','0452','0456','0459') then ED (note: some researchers may also wish to include the professional component of the ED care – REV_CNTR = 0981) Else if REV_CNTR in ('0200','0201','0202','0203','0204','0207','0208','0209') then ICU Else if REV_CNTR in ('0206') then IMC Else if REV_CNTR in ('0210','0211','0212','0213','0214','0219') then CCU Else other acute care
Long-Term Care Hospital (LTC)	**Inpatient Base**	Substr(prvdr_num,**3**,**2**) in ('20','21','22')

Inpatient Rehab Facility (IRF)	**Inpatient Base**	Substr(prvdr_num,**3**,**2**) in ('30') or substr(prvdr_num,**3**,**1**) in ('R','T')
Inpatient Psychiatric Facility (IPF)	**Inpatient Base**	Substr(prvdr_num,**3**,**2**) in ('40','41','42','43','44') or substr(prvdr_num,**3**,**1**) in ('M','S')
Critical Access Hospitals (CAH)	**Inpatient Base**	Substr(PRVDR_NUM,3,2) = '13'
Other Inpatient Claims	**Inpatient Base**	not in any of above classifications (e.g, Children's Hospitals)
Skilled Nursing Facility (SNF)	**SNF Base** NCH_CLM_TYPE_CD = 20, 30	
	All non-Swing bed SNF claims SNF Revenue Center File	The base claim record links with a revenue center record with REV_CNTR = '0022'
	Swing Bed SNF Revenue Center File	The base claim record does NOT link with a revenue center record with REV_CNTR =' 0022'
Home Health Agency (HHA)	**HHA Base** NCH_CLM_TYPE_CD = 10	
Hospice	**Hospice Base** NCH_CLM_TYPE_CD = 50	
Rural or Federally Qualified Health Center (RHC) (FQHC)	**Outpatient Base** NCH_CLM_TYPE_CD = 40	For RHC: (CLM_FAC_TYPE_CD='7' and CLM_SRVC_CLSFCTN_TYPE_CD='1') Or for FQHC: (CLM_FAC_TYPE_CD='7' and CLM_SRVC_CLSFCTN_TYPE_CD='3')
Hospital Outpatient (HOP)	**Outpatient Base**	not RHC or FQHC
	Outpatient ER Services Outpatient Revenue Center File	REV_CNTR in ('0450','0451','0452','0456','0459') (note: some researchers may also wish to include the professional component of the ED care – REV_CNTR = 0981; professional services will also be found in the Part B claims)
Part B Non-Institutional Claims (note: Carrier and DME are in separate files)		
Ambulatory Surgical Center (ASC)	**Part B Carrier Line File** NCH_CLM_TYPE_CD =71,72	LINE_CMS_TYPE_SRVC_CD =' F'
Part B Drug	**Carrier Line File**	BETOS_CD in ('I1E','I1F','O1D','O1E','O1G')
Lab tests	**Carrier Line File**	1st digit of BETOS_CD = 'T'
Imaging	**Carrier Line File**	1st digit of BETOS_CD =' I'
Medicare	**Carrier Line File**	1st digit of BETOS_CD = 'M'

Physician Fee Schedule (MPFS)		(also known as evaluation & management services)
Procedures	**Carrier Line File**	1st digit of BETOS_CD =' P'
Other Carrier	**Carrier Line File**	All other carrier claims
DME	**DME Line File**	BETOS_CD in ('D1A','D1B','D1C','D1D','D1E','D1F')
Parenteral/ Enternal (PEN) Claims	**DME Line File** NCH_CLM_TYPE_CD = 81,82	BETOS_CD = 'O1C'
DME Drugs	**DME Line File**	BETOS_CD in ('D1G')
Prosthetics &, Orthotics (POS) Claims	**DME Line File**	BETOS_CD ='D1F'
Durable Medical Equipment (DME) Claims	**DME Line File**	All other DME claims

The following SAS® code examples illustrate how to identify the claim records for the care settings of interest.

Code example 2: Demonstrate partitioning the data file into specific types of inpatient settings.

The following SAS® code is designed to subset the claims in the Part A Inpatient Base claims file into smaller files which are specific to the different hospital care settings. For this DATA step we end up with six inpatient setting-specific files: 1) acute, 2) long term care hospital, 3) inpatient rehabilitation hospital, 4) inpatient psychiatric hospital, 5) critical access hospital, and 6) other inpatient.

```
data  acute_b  ltc_b  irf_b  ipf_b  cah_b  oth_b;
      set a.inpatient_base_claims_J (keep=clm_id bene_id nch_clm_type_cd
      clm_from_dt clm_thru_dt nch_bene_dschrg_dt
      ptnt_dschrg_stus_cd  prvdr_num  org_npi_num  at_physn_upin
      at_physn_npi op_physn_upin op_physn_npi
      ot_physn_upin ot_physn_npi clm_utlztn_day_cnt  clm_non_utlztn_days_cnt
      clm_fac_type_cd clm_srvc_clsfctn_type_cd clm_ip_admsn_type_cd
      clm_src_ip_admsn_cd clm_drg_cd clm_drg_outlier_stay_cd
      nch_drg_outlier_aprvd_pmt_amt nch_bene_ip_ddctbl_amt
      nch_bene_pta_coinsrnc_lblty_am
      clm_pass_thru_per_diem_amt clm_pmt_amt icd_dgns_cd1 icd_dgns_cd2
      icd_dgns_cd3 icd_dgns_cd4 icd_dgns_cd5 icd_dgns_cd6 icd_dgns_cd7
      icd_dgns_cd8 icd_dgns_cd9 icd_dgns_cd10
      icd_prcdr_cd1 icd_prcdr_cd2 icd_prcdr_cd3 icd_prcdr_cd4 icd_prcdr_cd5
      icd_prcdr_cd6);

      if substr(prvdr_num,3,1) in ('0') then
            output  acute_b;
      else if substr(prvdr_num,3,2) in ('20','21','22') then
            output  ltc_b;
      else if substr(prvdr_num,3,2) in ('30') or substr(prvdr_num,3,1) in
      ('R','T') then
            output  irf_b;

      else if substr(prvdr_num,3,2) in ('40','41','42','43','44') or
      substr(prvdr_num,3,1) in ('M','S') then
            output  ipf_b;
      else if substr(prvdr_num,3,2) in ('13') then
            output  cah_b;
      else output  oth_b;
run;
```

Code Example 3: Use the Part A Inpatient Revenue Center file to identify specific settings of care within the inpatient facility.

The following SAS® code is designed to subset the claims in the Part A Inpatient revenue center file into smaller files which are specific to care settings. For this DATA step we end up with four inpatient setting-specific files: 1) emergency department, 2) intensive care, 3) intermediate care, and 4) all other inpatient revenue centers.

```
data  ed  icu ccu imc  oth_ip_revs;
set a.inpatient_revenue_center_J;
```

```
   rename clm_thru_dt=rev_cntr_dt;

  if  rev_cntr in ('0450','0451','0452','0456','0459') then output ed;

  else if rev_cntr in
('0200','0201','0202','0203','0204','0207','0208','0209') then output icu;

  else if rev_cntr in ('0210','0211','0212','0213','0214','0219') then
output ccu;

  else if rev_cntr in ('0206') then output imc;

  else output oth_ip_revs;
 run;
```

Code Example 4: Use the Part B Carrier line file to identify claim settings for carrier claims**.**

The following SAS® code is designed to identify service types in the Part B Carrier file. Service types that are identified include Ambulatory Surgical Center (ASC), Part B Drug (B_DRUG), Physician Fee Schedule Evaluation and Management (EM), Procedure (PROC), Imaging (IMG), Laboratory (LAB), DME claims within the Carrier file (DME_C), and Other Carrier (OTHC). These service types can be further segmented using BETOS Codes derived from HCPCS codes.

```
data  b.PtB(keep=bene_id clm_id line_1st_expns_dt line_last_expns_dt
org_npi_num prf_physn_npi prf_physn_upin
provider_id tax_num prvdr_zip line_nch_pmt_amt line_bene_pmt_amt
line_coinsrnc_amt line_bene_pay
srvc_1 srvc_2 betos_cd hcpcs_cd line_icd_dgns_cd mtus);
set a.bcarrier_line_j;
length provider_id $12 srvc_1 srvc_2 $6;
     if PRF_PHYSN_NPI not in ('^','~','') then provider_id=PRF_PHYSN_NPI;
   else if PRF_PHYSN_UPIN not in ('^','~','') then
provider_id=PRF_PHYSN_UPIN;
else provider_id='';
if carr_line_mtus_cnt~=. then mtus=carr_line_mtus_cnt;
first_srvc_dt=datepart(line_1st_expns_dt);
last_srvc_dt=datepart(line_last_expns_dt);
line_bene_pay=line_bene_pmt_amt + line_coinsrnc_amt;
betos1=substr(betos_cd,1,1); betos2=substr(betos_cd,1,2);

if LINE_CMS_TYPE_SRVC_CD='F' then srvc_1='ASC';

else if betos_cd in ('I1E','I1F','O1D','O1E','O1G') then  srvc_1='B_DRUG';

else if betos1='M' then  srvc_1='EM';

else if betos1='P' then srvc_1='PROC';

else if betos1='I' then srvc_1='IMG';

else if betos1='T' then srvc_1='LAB';

else  srvc_1='OTHC';

format line_1st_expns_dt line_last_expns_dt mmddyy10.;
```

```
run;

/* tabulations -*/
proc freq data= b.PtB;
tables  srvc_1 ;
title "Part B Carrier Service Events";
run;
```

Code Example 5: Use the Part B DME Line file to identify claim settings for DME claims.

> The following SAS® code is designed to identify subsets of services within the Part B DME claims. DME drug (DMEDG), Parenteral and Enteral Nutrition (PEN), and Prosthetics & Orthotics (POS) are identified as subsets of DME claims.

```
data  DME_line(keep=bene_id clm_id line_1st_expns_dt line_last_expns_dt
prvdr_npi prvdr_num
provider_id tax_num line_nch_pmt_amt line_bene_pmt_amt line_coinsrnc_amt
line_bene_pay
srvc_1 srvc_2 betos_cd hcpcs_cd line_icd_dgns_cd mtus);
set a.DME_line_j;
length provider_id $12 srvc_1 srvc_2 $6;
length provider_id $12 srvc_1 srvc_2 $6;
     if prvdr_npi not in ('^','~','') then provider_id=prvdr_npi;
   else if prvdr_num not in ('^','~','') then provider_id=prvdr_num;
else provider_id='';
if dmerc_line_mtus_cnt~=. then mtus=dmerc_line_mtus_cnt;
first_srvc_dt=datepart(line_1st_expns_dt);
last_srvc_dt=datepart(line_last_expns_dt);
line_bene_pay=line_bene_pmt_amt + line_coinsrnc_amt;
betos1=substr(betos_cd,1,1); betos2=substr(betos_cd,1,2);
srvc_1='DME';
if betos_cd in ('D1G') then srvc_2='DMEDG';
if betos_cd='O1C' then do; srvc_1='DME'; srvc_2='PEN'; end;
if BETOS_CD ='D1F' then do; srvc_1='DME'; srvc_2='POS'; end;
if srvc_2='' then srvc_2='OTHDME';
run;


proc freq data= DME_line;
tables srvc_1 srvc_2;
title "DME Service Events";
run;
```

Once the data are partitioned into settings, the claims files are more compact, and it is simpler to query the relevant files to determine the medical services that have been received by the study population.

Constructing a Longitudinal Data File

Before attempting to merge the utilization file with the denominator/sample file, you will need to sort both data files by BENE_ID. Carefully consider the appropriate merging method to use, depending on whether you want to include all beneficiaries, regardless of service use – or if you only want to keep beneficiaries for whom there is utilization information. Note that some beneficiaries will have many claims (i.e., this will require a many-to one merge with claims to beneficiary information), therefore to

improve efficiency it is sometimes advisable to defer joining person-level information (e.g., the denominator) with the claims information until the files have been processed and summarized as desired. For some analytic tasks, the utilization file will be extremely large, and special data management activities may be in order. For example, you may wish to use SAS® PROC SQL (rather than a SAS® Data step) to more efficiently handle this sort and merging process. This type of processing negates the need for a separate sorting step.

An alternative method of managing a large data file is to partition the utilization data file into smaller files (e.g., files based on settings; types of services or procedures; monthly files based on service date) and then sort each file and loop through all the small files, extracting only the utilization records of interest. There may also be times when it is appropriate to restrict your data file only to Medicare service users to more efficiently examine patterns of utilization.

Multiple years of claims data may be required in order to determine whether an event occurred or not. It will be especially important to be efficient with regard to the number of variables to retain.

Tabulating or Summarizing Utilization

You have many options for exploring and describing utilization. Numerous variables in the claims files make it possible to classify the types of services received (i.e., care setting and procedures), and the reason (i.e., diagnosis) for the care. There are also many options for the unit of analysis (e.g., number of visits, total hospitalized days, per capita utilization). Below some common methods for counting and summarizing utilization are presented.

- **Tabulating Utilization of Care**

As discussed above, to examine patterns of medical utilization, it is sometimes necessary to combine information from different claim types so that a complete assessment of the care taking place in a particular setting is obtained.

Code Example 6: Use both the base and revenue center records to identify care received in specific settings.

For this example we are seeking to identify all ED care. Various tabulations are performed.

> The following SAS® code is designed to merge data for ED care, which may appear in various claim types and care settings. The subset of Part A Inpatient revenue centers for ED services (using the file created in the DATA step for code example 3, called ***ed***) are merged with the subset of Part A Outpatient revenue centers for ED services (created as the first step in this coding example, called ***op_ed***). The input files are sorted by BENE_ID and date of service.

```
data  op_ed;
set a.outpatient_revenue_center_j;
where substr(rev_cntr,1,3)='045';
run;

/*sort the 2 input files which contain ED claims, then merge*/

proc sort data =  op_ed;
      by bene_id rev_cntr_dt;
run;
```

```
proc sort data= ed;
      by bene_id rev_cntr_dt;
run;

data all_ed;
      set op_ed (in=o) ed (in=i);

      if o then
            op_ed=1;

      if i then
            ip_ed=1;
run;
proc sort data=all_ed;
      by bene_id;
run;

/*create a small data file which counts per bene ED use by IP and Outpatient
settings*/

proc means data=all_ed noprint;
      by bene_id;
      output out=bene_ed(drop=_freq_ _type_) sum(op_ed ip_ed)=;
run;

/*bring in coverage and demographic variables*/

data bene_ed_cov;
      merge b.coverage bene_ed;
      by bene_id;
      if first.bene_id then bene_cnt=1;
      all_ed=sum(op_ed,ip_ed);
      if op_ed > 0 then op_user=1;
      if ip_ed > 0 then ip_user=1;
      if all_ed > 0 then ed_user=1;
run;

/*macro is designed to do various tabulations - first overall, then by
population subgroup - from the coverage file, which the user can specify */

%macro summ_ed (var= );
proc sort data=bene_ed_cov;
      by &var;
run;

proc means data=bene_ed_cov noprint;
      by &var;
      where ffs09='Y';
      output out=&var._summ(drop=_freq_ _type_) sum(op_ed ip_ed all_ed
op_user ip_user ed_user
      bene_cnt)=;
run;

data &var._summ;
      set &var._summ;
```

```
        op_1000bene=op_ed/bene_cnt * 1000;
        ip_1000bene=ip_ed/bene_cnt * 1000;
        all_1000bene=all_ed/bene_cnt * 1000;
        op_user_pct=op_user/bene_cnt * 100;
        ip_user_pct=ip_user/bene_cnt * 100;
        ed_user_pct=ed_user/bene_cnt * 100;
        label op_1000bene='OP ED visits per 1000 beneficiaries';
        label ip_1000bene='IP ED visits per 1000 beneficiaries';
        label all_1000bene='All ED visits per 1000 beneficiaries';
        label op_user_pct='Percentage of beneficiaries with an OP ED visit';
        label ip_user_pct='Percentage of beneficiaries with an IP ED visit';
        label ed_user_pct='Percentage of beneficiaries with either an OP or IP
ED visit';
run;
        proc print data=&var._summ;
        title "ED Visits";
        run;

%mend summ_ed;

/*Provides summary statistics overall, then for different demographic
variables*/

%summ_ed (var=mdcd09);
%summ_ed (var=dual_flag);
%summ_ed (var=rti_race_cd);
%summ_ed (var=bene_sex_ident_cd);
```

C. Describing Utilization

Identifying Care for a Particular Diagnosis

As an analyst, you may be interested only in certain types of care. For example, perhaps you only want to examine hospitalizations related to hip fracture or heart failure. Medicare classifies hospital discharges into DRGs. Each DRG has a payment weight assigned to it, based on the average resources used to treat Medicare patients in that DRG. Researchers exploring reasons for inpatient service use may find it helpful to use the DRG_CD variable in the Part A Inpatient data file. Please note that DRG changed to MS-DRG in the 3rd quarter of 2007, and the updated codes appear in the same data field, therefore, the values don't mean the same thing).

Similarly, a common way to examine reasons for care is to the look at the primary (or principal) diagnosis on the claim (DGNSCD1). This is the medical or surgical reason that hospitalization or skilled nursing care was required. The diagnosis code is a more granular system than DRG (i.e., many diagnosis codes may fall into a single DRG).

Additional diagnoses are present if there are complicating factors (e.g., may not be the major reason for the stay/visit, but have a bearing on the condition of the patient). These are called secondary diagnosis codes (i.e., DGNSCD2- DGNSCD25; beginning with claims files from 2009, up to 25 diagnosis codes may appear on the claim – which is known as the version J data file layout, whereas previously there were only up to 10). It is common to see a condition such as diabetes listed as a secondary diagnosis – a co-occurring condition which must be managed, rather than the major cause of the hospitalization.

Identifying Care for Individuals with a Particular Condition or Diagnosis

Your analysis may seek to determine whether the medical care received indicated that a health condition was present, or whether some routine types of care were provided. It may be important to examine more than one claim to make this determination. In the CCW, for example, varieties of common and chronic conditions in the Medicare population are pre-coded and appear in the BASF (the Beneficiary Annual Summary File, historically referred to as the Chronic Conditions Summary File). The algorithms for these conditions are very precise regarding the number of claims, the specific types of services, and the number of years of data which must be examined to make a CCW determination regarding whether a person was likely receiving care for a particular condition. Note that the use of this information assumes that if a claim was processed with a particular diagnosis code, the patient was receiving care for that particular diagnosis. It is important to include in analyses only those diagnosis codes of interest, and exclude (if desired) any screening or preventive care codes that do not represent a definitive diagnosis. Furthermore, please note that administrative claims data will only represent beneficiaries receiving FFS care for a particular condition within the time period of the claims data set used in the analysis.

Refer to the CCW condition algorithm documentation on the website (http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditioncategories.pdf). These definitions are not prescriptive; you may use whatever claims-based algorithms are appropriate for your analysis.

Patterns of utilization for a group identified as having a condition of interest can also be examined but a cautious approach is recommended. The data files contain all claims; they are not limited to claims for a particular condition. You will want to be careful about attributing health service utilization, or the associated costs of care, to a particular condition (e.g., fractures may be related to trauma rather than osteoporosis; a person with diabetes may be hospitalized for a cardiac event rather than the diabetes). It is not unusual for Medicare beneficiaries to have multiple chronic conditions, making attribution difficult (see paper describing multiple chronic conditions in the Medicare population: (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2748070/).

Identifying Particular Procedures

You may be interested in determining whether certain procedures or interventions were received by the patient (i.e., the claims have HCPCS codes). HCPCS codes can be divided into two major categories – the Level 1 (i.e., CPT codes) and Level II HCPCS codes. The CPT codes are proprietary and maintained by the American Medical Association (AMA), whereas the HCPCS Level II codes are maintained by CMS. Documentation regarding HCPCS codes can be found on the CMS website (http://www.cms.gov/MedHCPCSGenInfo/) or through a variety of published reference manuals.

Detailed procedure information is important if looking at particular tests or interventions (e.g., cancer screening, immunization, surgical procedures).

Code Example 7: Identify claims for a cohort with a particular condition of interest.

> The following SAS® code is designed to identify a sample of beneficiaries with Heart Failure (HF; input file = BASF) who had full/nearly full FFS coverage (input file=coverage). Then evaluate the procedure codes performed for those beneficiaries during one year, using inpatient claims.
>
> After the initial sample is identified and a file is created containing the BENE_ID for each beneficiary in the sample, inpatient claims are merged to this file for analysis of procedure codes.

```
proc sort data= b.coverage;
      by bene_id;
run;
proc sort data=a.BASF_FIle out=cc;
      by bene_id;
run;

*Restrict to a Heart Failure sample - make finder file of these BENE_IDS;

data hf (drop=chf);
merge b.coverage (in=x) cc (in=y keep=bene_id chf);
by bene_id;
if x and y and chf in (1,3);
run;

/*This SQL code statement can be used to replace the prior data step and
sorts*/

proc sql;
  create table hf as
  select b.bene_id
  from a.basf_file as a, b.coverage as b
  where a.bene_id=b.bene_id and
  a.chf in (1,3);
quit;

*Pull Associated HF claims for these benes;

proc sort data=a.inpatient_base_claims_j (keep=clm_id bene_id)
            out=hfaclms_all nodupkey;
by bene_id clm_id;
run;

data hf_aclms;
merge hf (in=s) hfaclms_all (in=t);
by bene_id;
if s and t;
run;

proc sort data=hf_aclms out=hfaclms nodupkey; by clm_id; run;

proc sort data=a.inpatient_base_claims_j out=inpatient_base_claims_j;
      by clm_id;
run;

data hfclms;
merge hfaclms (keep=clm_id in=d)
      inpatient_base_claims_j (in=e);
by clm_id;
if d and e;
run;

/*create SAS data sets with claim counts for non-missing Procedure codes
25 Procedure Codes are Available with the New Version J layout*/
```

```
%macro p(num=);
proc freq data= hfclms noprint;
where icd_prcdr_cd&num. ne '';
tables icd_prcdr_cd&num. / out=prcdr&num.
(rename=(icd_prcdr_cd&num.=icd_prcdr_cd
count=count&num.));
run;

%mend p;
%p(num=1);
%p(num=2);
%p(num=3);
%p(num=4);
%p(num=5);
%p(num=6);
%p(num=7);
%p(num=8);
%p(num=9);
%p(num=10);
%p(num=11);
%p(num=12);
%p(num=13);
%p(num=14);
%p(num=15);
%p(num=16);
%p(num=17);
%p(num=18);
%p(num=19);
%p(num=20);
%p(num=21);
%p(num=22);
%p(num=23);
%p(num=24);


/*combine all Procedure Codes and Counts together;*/

data hf_aggr_prcdr_cds (drop=percent count1-count25);
merge prcdr1 prcdr2 prcdr3 prcdr4 prcdr5 prcdr6 prcdr7 prcdr8
prcdr9 prcdr10 prcdr11 prcdr12 prcdr13 prcdr14 prcdr15 prcdr16
prcdr17 prcdr18 prcdr19 prcdr20 prcdr21 prcdr22 prcdr23 prcdr24
prcdr25;
by icd_prcdr_cd;
count=sum(of count1-count25);
run;

/*create one table with primary counts and counts;*/

data hf_prcdr_cd_cnts;
merge hf_aggr_prcdr_cds prcdr1 (drop=percent);
by icd_prcdr_cd;
run;

proc print data=hf_prcdr_cd_cnts;
title 'frequency of each procedure code';
run;
```

Calculating Payments for Services

Using the claims data, there are different ways you can examine the payments made for services. The three major perspectives are the:

- Cost of the service borne by the beneficiary (note: this may include deductible and coinsurance amounts, and, for inpatient Medicare services, may include an additional deductible for blood products)
- Amount paid by Medicare
- Total payment amount

For each claim type, these payment variables are present, although the names vary a bit. In addition, by manipulating the data fields you can determine added information, such as the amount paid by third party payers (e.g., by comparing the primary payer paid amount field [PRPAYAMT] to the amount paid by Medicare [PMT_AMT]). A charge amount may also appear on the claim; however these do not necessarily constitute allowable charges or amounts paid by Medicare.

When examining payment information, it is recommended that you remove all denied claims and denied revenue center or line detail on claims which were not denied. Payment fields appear on both the base claim and the revenue center/line records. The base claim total payment is the sum of the revenue center/line record payments.

Tables 5 and 6 below present the variable names for certain types of payment found on Non-Institutional and Institutional Medicare claims.

Table 5: Variable names for Payment on Non -Institutional Claims

Payment Type	**Non-Institutional Claims (on CMS 1500 form)**	
	Carrier (Base File)	**Carrier (Line Item File)**
Medicare payment	PMT_AMT	LINEPMT
Beneficiary payment	DEDAPPLY + COINAMT	LDEDAMT + COINAMT
Primary Payer payment	PRPAYAMT	LPRDAMT
Payment Due to the Provider	n/a (could sum 3 above fields) or use ALOWCHRG	n/a (could sum 3 above fields) or use LALOWCHG

Table 6: Variable names for Payment on Institutional Claims

Payment Type	Institutional Claim Type (on CMS 1450 From)				
	Inpatient or SNF (Base File)	**HHA (Base File)**	**HHA (Revenue Center File)**	**HOP (Base File)**	**HOP (Revenue Center File)**
Medicare payment	PMT_AMT + (PER_DIEM*UTIL_DAY)	PMT_AMT	REVPMT	PMT_AMT	REVPMT or RPRVDPMT (provider portion)
Beneficiary payment	DED_AMT + COIN_AMT + BLDDEDAM	none	WAGEADJ	PTB_COIN + PTB_DED + BLDDEDAM	PTNTRESP
Primary Payer payment	PRPAYAMT	PRPAYAMT	REV_MSP1 + REV_MSP2	PRPAYAMT	REV_MSP1 + REV_MSP2
Payment due to the Provider	n/a (could sum 3 above fields)	n/a (could sum 3 above fields)	n/a (could sum 3 above fields)	n/a (could sum 3 above fields)	n/a (could sum 3 above fields)

Some common methods, and sample code, for examining utilization are shared below.

- Per Capita and Per User rates

Code Example 8: Find the proportion of Medicare FFS beneficiaries who used acute inpatient care during the year.

Consider whether you want to restrict the claims file to a particular population subset (e.g., only those with FFS coverage, or only those of a certain age). Here we examine acute utilization and payment only for beneficiaries with full FFS.

The following SAS® code is designed to identify all beneficiaries enrolled for the full year (or until time of death), and all those with an acute inpatient claim. Then we tabulate per beneficiary and per user payments.

The input data sources were created above, and consist of the ***coverage*** file (from code example 1 - to specify inclusion of beneficiaries enrolled in FFS, or to be able to identify the demographic characteristics of users) and the acute base claims file ***acute_b*** *(from code example 2)*. Files are sorted, and then merged. Finally, tabulations summarize care for the entire cohort.

```
/*sort the 2 input files, then merge*/

proc sort data= acute_b;
      by bene_id clm_id;
run;

proc sort data=a.coverage out=coverage;
      by bene_id ;
 run;

data acute_cov;
      merge coverage  acute_b;
      by bene_id;
      run;

/* identify full FFS beneficiaries and acute inpatient care users*/
data a.acute;
      set acute_cov;
      by bene_id;

      if first.bene_id then
            bene_cnt=1;

      if first.bene_id and clm_pmt_amt~=' ' then
            user_cnt=1;

            if ffs09='Y';
run;

/*creating a file consisting of a summarized dataset*/

proc means data=a.acute noprint;
      output out=acute_summ(drop=_freq_ _type_) sum(clm_utlztn_day_cnt
clm_pmt_amt
            nch_bene_ip_ddctbl_amt bene_cnt user_cnt)=;
run;

/*Per User and Per Capita Days & Payments*/

data acute_summ;
      set acute_summ;

      format clm_utlztn_day_cnt 10.;
      acute_pmt_per_user=round(clm_pmt_amt/user_cnt,.01);
      acute_pmt_per_cap=round(clm_pmt_amt/bene_cnt,.01);

      label acute_pmt_per_user='Per User Acute Payments'
       acute_pmt_per_cap='Per Capita Acute Payments'
       clm_utlztn_day_cnt='IP days'
       clm_pmt_amt='Total IP Payments'
       nch_bene_ip_ddctbl_amt='Total IP bene deductible amounts';
run;

proc print data=acute_summ;

run;
```

- Rates of Events – such as Acute Inpatient Hospital Readmissions

If you are examining all acute inpatient hospital stays, we recommend combining two of the Part A Inpatient settings identified earlier in the code examples – the acute and CAH.

Code Example 9: Identify people who experience a particular event, a hospital readmission.

Several data processing steps are necessary to accomplish this task.

First we identify all beneficiaries with an acute inpatient or CAH claim, and then sort the claims in date order to identify all inpatient stays. Transfers to different facilities are identified, so that they are not confused with readmissions (i.e., where there is a break in the acute stay, during which time a lower level of care may be provided, then another inpatient admission occurs).

> The following SAS® code is designed to identify all acute and CAH inpatient hospitalizations.
>
> The input data sources were created above (in code example 2), and consist of the ***acute_b*** file (IP acute base claim records) and the CAH base file ***cah_b***. Files are sorted, and then merged to identify transfers.

```
proc sort data=acute_b out=b.acute;
by bene_id descending CLM_FROM_DT descending CLM_THRU_DT clm_id;
run;

proc sort data=cah_b out=b.cah;
by bene_id descending CLM_FROM_DT descending CLM_THRU_DT clm_id;
run;

data IPstays(drop= temp_dt temp_prov);
      set b.acute b.cah;
      by bene_id descending CLM_FROM_DT descending CLM_THRU_DT clm_id;
      retain stays temp_dt temp_prov;
      if first.bene_id then do;
            stays=1; temp_dt=CLM_FROM_DT; temp_prov=PRVDR_NUM;
      end;
      else do;

      if ~(NCH_BENE_DSCHRG_DT=.  or
            (temp_dt=CLM_THRU_DT and temp_prov~=prvdr_num)) then stays+1;
      if (temp_dt=CLM_THRU_DT and temp_prov~=prvdr_num) then transfer=1;
      end;
      temp_dt=CLM_FROM_DT; temp_prov=PRVDR_NUM;
run;

proc means data=IPstays noprint;
      by bene_id;
      output out=bene_IPstays(drop=_freq_ _type_) max(stays)=
sum(transfer)=;
run;

proc freq data=bene_IPstays;
      tables stays transfer;
      title "number of IP stays and transfers";
run;

proc sort data= IPstays out=b.IPstays;
```

```
      by bene_id descending stays CLM_FROM_DT CLM_THRU_DT  descending
clm_id;
run;
```

The following SAS® code uses the ***IPstays*** file (created above, in code example 9) as the main input source for determining whether the patient experienced a hospital readmission.

Once the data are sorted into stays, a determination can be made regarding whether an acute hospitalization is a readmission. Users may specify their own time interval for a readmission; here we use 30 days.

The macro is used to tabulate readmissions – overall and by various demographic characteristics.

```
/****Merging Stay file with Coverage */
proc sort data=coverage out=b.coverage;
      by bene_id;
run;

proc sort data=IPstays;
      by bene_id;
run;

data IPstays2;
      merge b.IPstays (in=x) b.coverage;
      by bene_id;
      if x;
run;

proc sort data=IPstays2;
      by bene_id stays;
run;

/*Calculating readmissions - here a 30 day interval is used*/

data readmits;
set IPstays2;
by bene_id;
retain tempdate tempstd tempprov tempdrg;
admit_clm=0;

if first.bene_id then do;
      if PTNT_DSCHRG_STUS_CD not in ('20','07') and
      (bene_death_dt=' ' or bene_death_dt-clm_thru_dt>30)

      then do;
            admit_clm=1;
            readmit=0;
      end;
      tempdate=clm_from_dt; tempstd=clm_pmt_amt; tempprov=prvdr_num;
tempdrg=clm_drg_cd;
end;

else do;
      if PTNT_DSCHRG_STUS_CD not in ('20','07') and year(clm_thru_dt)=2009
      then do;
            admit_clm=1;
```

```
            readmit=0;
            if .<intck('day',clm_thru_dt,tempdate)<=30 then do;
                  readmit=1; readmit_pmt=tempstd; readmit_prov=tempprov;
                  readmit_drg=tempdrg;
            end;
      end;
      tempdate=clm_from_dt; tempstd=clm_pmt_amt; tempprov=prvdr_num;
tempdrg=clm_drg_cd;
end;
output;
run;

/*macro is designed to do various tabulations - first overall, then by
population subgroup - from the coverage file, which the user can specify */


%macro summ_read (var= );
proc sort data=readmits;
      by &var;
run;

proc means data=readmits noprint;
      by &var;
      where ffs09='Y';
      output out=&var._summ(drop=_freq_ _type_) sum(admit_clm readmit)=;
run;

data &var._summ;
      set &var._summ;
      readmit_rt=readmit/admit_clm * 100;
      label readmit_rt='Readmission Rate';
run;

proc print data=&var._summ;
      title "Readmission rates";
      run;

%mend summ_read;
%summ_read (var=mdcd09);
%summ_read (var=dual_flag);
%summ_read (var=rti_race_cd);
%summ_read (var=bene_sex_ident_cd);
```

Chapter 3: Further Assistance with CMS Administrative Claims Data

The Research Data Assistance Center (ResDAC) offers free assistance to those using Medicare data for research. The ResDAC website provides links to descriptions of the CMS data available, request procedures, supporting documentation, workshops on how to use Medicare data and other helpful resources. Visit the ResDAC website at (http://www.resdac.umn.edu).

In the event that a ResDAC technical advisor is not able to answer the question, the technical advisor will direct you to the appropriate person at CMS or Buccaneer.

Email: CMSdata@vangent.com

Appendix A: List of Acronyms and Abbreviations

Acronym	Definition
AMA	American Medical Association
AMB	Ambulance
ASC	Ambulatory Surgery Center
BASF	Beneficiary Annual Summary File
BETOS	Berenson-Eggers Type of Service
CAH	Critical Access Hospital
CC Summary	Chronic Condition Summary
CMS	Centers for Medicare &Medicaid Services
CCW	Chronic Condition Data Warehouse
DME	Durable Medical Equipment
DMERC	Durable Medical Equipment Regional Carrier
DRG	Diagnosis Related Group
DSH	Disproportionate Share Hospital
E&M	Evaluation and Management
ED	Emergency Department
ESRD	End Stage Renal Disease
FFS	Fee-for-Service
FI	Fiscal Intermediary
FOBT	Fecal Occult Blood Test
FQHC	Federally Qualified Health Center
HCPCS	Healthcare Common Procedure Coding System
HHA	Home Health Agency
HOP	Hospital Outpatient
HMO	Health Maintenance Organization
ICD-9	International Statistical Classification of Diseases and Related Health Problems
ICU	Intensive Care Unit
ID	Identification Number
IMC	Intermediate Care Unit
IME	Indirect Medical Education
IPF	Inpatient Psychiatric Facility
IRF-PAI	Inpatient Rehabilitation Facility
LTC	Long Term Care
LTCH	Long Term Care Hospital
MA	Medicare Advantage
MAC	Medicare Administration Contractor
MAPD	Medicare Advantage – Part D
MDS	Minimum Data Set
MPFS	Medicare Physician Fee Schedule
NDC	National Drug Code
OASIS	Outcome and Assessment Information Set
PDE	Prescription Drug Event

PDP	Prescription Drug Plan
PEN	Parenteral
ResDAC	Research Data Analytic Center
RHC	Rural Health Clinic
SNF	Skilled Nursing Facility