Paper 183-2011

Develop Effective Disease Management Program for Managed Care Organization Using SAS®

Qingfeng Liang, Community Care Behavioral Health Organization, Pittsburgh, PA

ABSTRACT

Individuals with chronic illnesses account for over 70% of the total health care costs in the United States. Chronic illness is extremely costly for health insurance payers due to high readmission rates and the large volume of care. Therefore, health insurance payers and health care providers increasingly seek to identify strategies to manage this patient population in order to reduce cost and improve patient care. Health insurance payers have data from various sources; how to evaluate data to support disease management initiatives and strategies becomes very challenging.

The paper focuses on four key processes to develop an effective disease management program. SAS solutions are implemented to build (1) Data Integration and Management; (2) High Risk Population Classification; (3) Intervention Automation; and (4) Outcome Evaluation and Management. Examples show how SAS solutions and Base SAS® data programming techniques are implemented for each process of the disease management program.

INTRODUCTION

Managed healthcare providers, health insurers and other organizations that pay for healthcare are constantly seeking ways to reduce the burden of healthcare costs. Individuals with chronic illnesses account for over 70 percent of total health care costs in the United States. Chronic illness is extremely costly for health insurance payers due to high readmission rates, and large volume of care. But how do you identify which patients have or are likely to develop a chronic illness? How do you know which interventions make the most medical and financial sense? Will the demand for medical resources match your supply? The answers to these critical questions and more can be found using disease management program.

Disease management is the process of coordinating and managing members who have chronic conditions and health management services along the full spectrum of health care delivery while striving to improve both clinical and economic outcomes through altering patient and provider behavior. The general idea is to ease the disease path, rather than cure the disease. Improving quality and activities for daily living are first and foremost. Improving cost, in some programs, is a necessary component, as well.

An effective disease management program should deliver accurate, timely information that enables you to predict risk and optimize interventions, so you can achieve both improved outcomes and cost saving. A lot of research findings show that disease management improves clinical processes of care, leads to better disease control, reduces hospital admission rates, and increases patient satisfaction and health-related quality of life, especially for depression in behavioral health.

Managed care organizations have never been under greater pressure to implement effective disease management programs that can identify patients at high risk for chronic illness and high-cost medical treatment. With all existing data sources and all available technologies, how we can develop an effective program to help improve the disease management process is a very challenging task.

An effective disease management program should support the following process:

- Data Integration and Management
- High Risk Population Classification
- Intervention Automation
- Outcome Evaluation and Management

By leveraging award-winning data integration and data mining software for predictive modeling, SAS solutions for disease management goes beyond traditional disease management solutions to offer. SAS provides perfect solutions to improve data exploitation, risk stratification, program design and outcomes reporting to reduce medical

costs. In this paper, implementations of SAS solutions to each of the four processes will be discussed in details.

DATA INTEGRATION AND MANAGEMENT

Managed care organizations usually receive numerous data sources from both internal and external sources. These sources typically include member and provider eligibility, in-patient and out-patient billing claims, pharmaceutical records, lab results and medical assessment questionnaires, reference resources, etc. Medical and pharmaceutical claims are the core information source for most disease management activities. They are good sources for indentifying prevalence of diseases, finding the patterns for treatment of diseases, calculating cost and resource utilization associated with treating diseases. However, claims records are designed to facilitate billing – not to provide a complete representation of population health characteristics. Also both internal and external data are complex in both structure and timing which presents numerous analytical and reporting challenges.

STRUCTURE AND CONTENT OF INSURANCE CLAIMS DATA

Insurance claims which include inpatient claims and outpatient claims are constructed differently in different databases, but most of them are one observation per member per visit and have some similar variables like:

Patient ID	Begin Date of service	End Date of service	Provider ID	Service code	Diagnosis	Units	Costs

Pharmacy claims are submitted by the pharmacies for patients with prescription drug coverage. Pharmacy claims usually contains following variables:

Patient ID	Date of prescription	Pharmacy ID	Drug code	Days supplied	Quantity	Costs

Patient biographic information

Patient ID	Patient Name	DOB	Gender	Address

Eligibility information

Patient ID	Coverage Begin Date	Coverage End Date	Coverage Group

REFERENCE TABLES

Insurance claims and pharmacy claims usually contain billing codes, service codes, diagnosis codes, drug codes and service provider ID, etc. Reference tables are created in the databases to give the definitions and descriptions to those codes.

SAS SOLUTIONS TO DATA INTEGRATION AND MANAGEMENT

How to integrate a variety of data sources together will result in a more complete picture of patient's treatment history. The idea solution is to use SAS Data Integration Studio to construct a centralized data warehouse. By doing

that, the data warehouse will create an integrated decision support environment to not only support disease management program but also support other reporting and analytical needs as well as hold cleaned and standardized data in an integrated fashion.

In Community Care Behavioral Health Organization (Community Care), two claim processing vendors are contracted historically. Two different vendors have their own different complex data structures of processed claims. This created numerous reporting challenges for analysts to get clean data sources from two systems.

Community Care applys SAS Data Integration platform to construct a centralized data warehouse which provides a common, standardized, open data repository for reporting and analysis. Figure 1 shows the implemented architecture the data warehouse which displays the complexity of the data sources and the route we took to integrate these sources together in our CDW database.

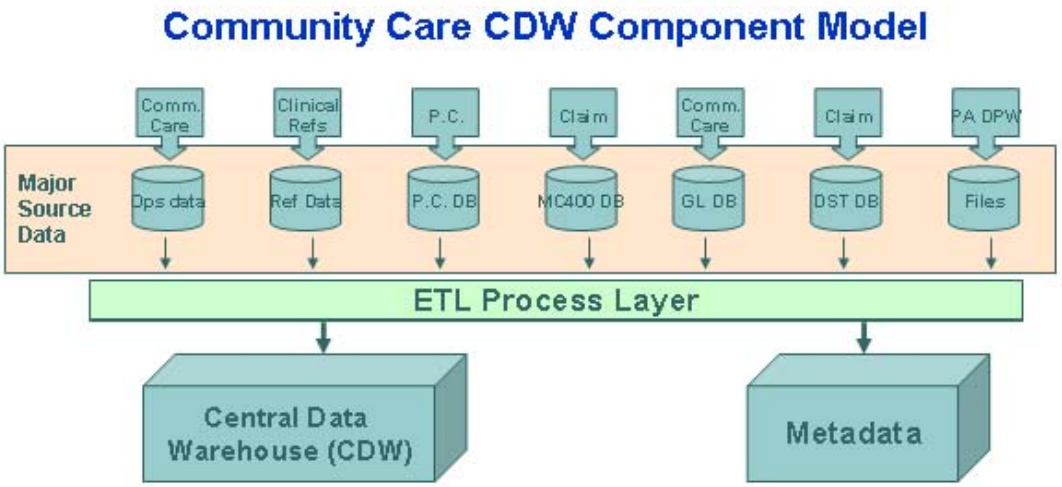

Figure 1: Community Care CDW Component Model

Since the insurance claims are constructed as one observation per service/visit per member, it will be very helpful if they can be constructed in different ways which will benefit various analyses, especially for disease management. For example, if a member was admitted into hospital for depression for a week, and there are several claims submitted by the provider for the whole inpatient stay. It is very helpful from analysis stand point that all these related claims are aggregated together into one record. Furthermore, if the same patient received follow-up outpatient care after inpatient discharge or maybe was readmitted into hospital again, etc. These follow-up services for this member can be integrated with the claim for initial service. Both longitudinal data structure and horizontal data structure can benefit data analysis for disease management program. Based on these requirements, different data marts are designed and implemented in star schema fashions and they will provide clean and integrated data sources for disease management, decision support, operations reporting, and outcomes analysis, etc.

Besides transformations embedded in SAS Data Integration Studio, Base SAS also offers several functions and statement which make data integration task easier, like .FIRST, .LAST, RETAIN, LAG and DIFF etc. The following sample of SAS codes gives you the idea of how to identify 30 days inpatient readmission.

```
/* Identify inpatient readmission within 30 days from claims */
data readmition(rename=(unique_id=readmit_uid uid=unique_id)
             drop=transfer admit);
    set inpatient;
by member_id service_start service_end;
retain uid ind_end;

if first.member_id then do;
    uid=unique_id;
    ind_end=service_end;
end;
else do;
    if (0<=service_start-ind_end <= 30) and transfer=0 then do;
      readmit=1;
      output;
      end;
    uid=unique_id;
    ind_end=event_end;
end;
run;
```

HIGH RISK POPULATION CLASSIFICATION

Significant portion of services was used by the most high-risk or high-cost members. How to identify the high risk members and classify the severity is very critical to disease management program. Many organizations employ predictive modeling or claims analysis to identify high-risk members. Patient's diagnosis within claim is one of the most important criteria to profile high risk members. Many health managed care organizations struggle with how to look at their members by diagnosis. Profiling members by diagnosis allows an organization to review patterns of care, monitor service utilization and costs of various conditions, and measure the impact of interventions.

When Community Care began to profile its population by mental health diagnosis, various methodologies and business rules were tested and compared to ensure their accuracy and practicality. During the development phase, many factors were considered for inclusion in the algorithms. First, it was decided that the recency of claims would be the key variable, in order to capture the latest clinical determination of a patient's evolving diagnosis. Second, the frequency of diagnosis needed to be included in order to capture a more complete picture of a patient's diagnostic history. Third, the intensity of the services provided to the patient was to be incorporated in the algorithms in various degrees. The assumption for this variable was that the more intense the service level, the more accurate would be the diagnosis assigned to the patient. Against these three considerations, the overall complexity of the calculations and the constraints of the organization's technical resources had to be considered as well.

In the algorithm ("Most Frequent/Most Recent") Community Care implemented, the goal was to choose the most frequent diagnosis on the most recent claims. For this method, the ten most recent claims for each mental health patient were selected for past 12 months. For each patient, the most frequently listed primary diagnosis was assigned from these ten claims.

For patients who have five claims assigned to two different diagnoses, the most recently assigned diagnosis was chosen. Again, if the two most recent claims were on the same day, the claim with the most intensive service type was selected. If the two most recent claims were on the same day and had the same service type, the claim with the highest dollar amount paid was picked.

Many patients in the population did not have ten claims in past 12 months. For these patients, the most recent two claims were compared. If the primary diagnosis matched on both claims, this diagnosis was assigned to the patient. If a match was not found, the next most recent claim was selected until a majority of claims listed the same primary diagnosis.

Diagnostic assignments are made by the organization each month, with the twelve most recent claim months included in the calculations. The cohort assignment made at the end of each month is based on the diagnosis, the frequency of the claims and the total utilization for each member. The members with high claim volume and high cost can be classified into disease management program on consistent basis. The care mangers can update the member list on monthly basis.

All these implementations are done with intense SAS programming with base SAS. Sample of SAS codes which show how to loop through all claims for each member to apply the algorithm defined are attached to the appendix.

INTERVENTION OPTIMIZATION

Intervention is the key to improve patient care and control service utilization for members with chronic diseases. SAS provides solutions to optimize the effective intervention and employs advanced reporting capabilities to facilitate the intervention process.

Identified high risk members are informed to enroll into disease management program. SAS Macro can be used to generate member profiling reports on monthly basis automatically and it will allow care managers to track the members in disease management program. The member will be flagged when follow-up care is needed, and the providers will be notified by care manager to provide timely care. Members in disease management program will also be notified by phone calls and by letters when they need to get appropriate care and patient education. SAS data quality module provides a perfect solution to standardize providers' and patients' contact information. It can improve the rates which providers and patients get the notices in time.

On the other hand, predictive models can be implemented to trigger members whom were predicted with high possibility to be high risk members. Care managers will notify health provider and members with possible early intervention. Early intervention could eliminate a lot of high cost inpatient admissions.

OUTCOME EVALUATION AND MANAGEMENT

Does the program improve patient care and also save the cost? The outcomes will determine at the end whether disease management program is successful or not. The SAS solution supports outcome evaluation, service utilization and expenditure reporting, etc. to track the progress and effect of the intervention and patient care. There are several outcome measures which are commonly adopted into disease management program, like volume of services within certain time period, DAYS/1000, CASES/1000, Over/Under Threshold, VISITS/1000, COST/1000, UTILIZATION/1000, READMISSION RATE, OUTPATIENT FOLLOW UP RATE, ROI (return on investment), etc. These measures can be automated into disease management and health reports which are generated by month by quarter using SAS Macro and ODS. It allows care managers to focus on evaluating the improvement of patients' health and service utilization rather than spending time to manually create the reports. More importantly, the data and the reports are more reliable and more readily available internally and also externally.

With collaboration with researchers and clinicians from well known research institutes, good treatment guidelines can be established, for example treatment for depression, we consider that a good quality depression treatment should consist of at least 4 psychotherapy visits during the first 12 weeks of a depression episode. With this guideline, we make sure patients with depression getting good quality care. Disease management program achieve its goal of both improving patient health and cost saving.

CONCLUSION

Although the insurance claims and other data sources are complicated in health care setting, the SAS solutions can be implemented to develop an effective disease management program for managed care organizations. By implementing disease management program, managed care organizations can be more effective to improve members' health and control spending.

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ACKNOWLEDGEMENTS

CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the author at:

Qingfeng Liang, Lead Programmer
Community Care Behavioral Health Organization
Suite 700, Chatham One Center
Pittsburgh, PA 15241
Phone: 412-402-8748
Fax: 412-454-2177
E-mail: liangQ@ccbh.com
Web: www.ccbh.com

APPENDIX

```
/*************************************************************/
/* part of the algorithm to assign diagnosis for each member */
/*************************************************************/
proc sql noprint;
  select max(membnum) into: maxmemb
  from claims;
quit;


%do i=1 %to &maxmemb;

proc sql noprint;
 /* Max Num of Claims for Memb i */
  select max(count) into:maxcount
  from claims
  where membnum=&i;
quit;

/* for memb only has single claim */
%if &maxcount=1 %then %do;
data memb&i(keep=member_id svc_dat end_dat diagnosis);
  set under_ten;
  where membnum=&i;
run;
%end;

/* for memb has more than 1 claims */
%else %do;

/* freq of certain code */
%let mostcode=1;
%let j=1;

%do %while( &mostcode < 2 and &j < 9 );

%let j=%eval(&j + 1);

/* choose most recent number of j claims for memb i */
data recent;
  set under_ten;
  where count <= &j and membnum=&i;
run;

proc sort data=recent;
  by member_id diagnosis;
run;

/* summarize to get freq by diagnosis */
proc means data=recent noprint;
  var amt_paid;
  by member_id diagnosis;
  output out=recent_freq(rename=(_freq_=Freq)) mean=;
run;

/* get max number of freq by diagnosis */
proc sql noprint;
  /*title "Max Num of Most recent &j claims per Memb";*/
  select max(freq) into: mostcode
  from recent_freq;
  quit;
```

```
/* no duplicate diagnosis, choose the most recent one */
%if &j >= 9 and &mostcode=1 %then %do;
proc sort data=recent;
  by member_id descending svc_dat descending amt_paid;
run;

data memb&i(keep=member_id svc_dat diagnosis);
  set recent;
  by member_id descending svc_dat descending amt_paid;
  if first.member_id;
run;
%end;

/* choose member when freq of diagnosis hits 2 */
%if &mostcode=2 %then %do;
data memb_&i(keep=member_id diagnosis);
  set recent_freq;
  where freq=&mostcode;
run;

proc sort data=recent;
  by member_id diagnosis;
run;

data memb&i;
  merge memb_&i(in=a) recent(in=b);
   by member_id diagnosis;
  if a and b;
run;

proc sort data=memb&i;
  by member_id descending svc_dat descending amt_paid;
run;

data memb&i(keep=member_id svc_dat end_dat diagnosis);
  set memb&i;
  by member_id descending svc_dat descending amt_paid;
  if first.member_id;
run;

%end;

%end;

%end;

%end;
```