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****************STANDARDPROGRAM DOCUMENTATION******************;
PROGRAM NAME:  Gap_measure_numerator.SAS
LOCATION: D:\Hu\VA copay study\SAS Program\Analysis - Step3 (Unmodified INCQ)\Constructing data
PROGRAMMER:    HU XIE
BEGAN:         4/5/2005
LAST MODIFIED: 4/5/2006
DESCRIPTION:   Create numerator for Gap Measure as accommodating Gap_measure_denominator.sas
*****************************************************************;

PTIONS NOCENTER FORMDLIM='-' nodate LS=160 PS=44 ERRORS=3 ;
ibname statin 'D:\Adherence\Statin\Statin Data';

-------------------------------------------------------------------------*
  Step one: Carry over the overlapped days within the sample CV class

        1. Create unique ID by FAKE_PATIENT and VA_CLASSIFICATION for
           purpose of using first. and last. function to set new drug
           usage start date and end date of each CV class for each
           patient;
-------------------------------------------------------------------------*;
)roc sort data=statin.sample(where=(VA_CLASSIFICATION='CV350')) out=test;
)y fake_patient va_classification start_date;
'un;

lata days;
   set test;
   length uniqid $40.;
   uniqid=compress(put(fake_patient, 20.))||substr(va_classification,1,5);
'un;
)roc sort data=days; by uniqid; run;

lata days;
   set days;
   by uniqid;

      retain startd stopd suppdays stopd_old;
      if first.uniqid then do;
          startd=start_date;
          stopd=stop_date;
          suppdays=days_supply;
          stopd_old=stopd;
      end;

      else do;
          stopd_old=stopd;
          if start_date<=stopd_old then do;
              startd=stopd_old+1;
              suppdays=days_supply;
              stopd=startd+suppdays;
          end;
          else do;
              startd=start_date;
              stopd=stop_date;
              suppdays=days_supply;
          end;
```

```
    end;
format startd stopd stopd_old mmddyy10.;
drop start_p stop_p p_stop_p p_stop_date presdays;* stopd_old;
;


-------------------------------------------------------------------------*
    2. Set new start_p (1=pre, 2=middle or 3=post period) variable according to
       the new start and stop date;
-------------------------------------------------------------------------*;
a days;
 set days;

 IF startd<'01NOV1999'D THEN START_P=0;
 ELSE IF '01NOV1999'D <= startd <= '31OCT2000'D THEN start_P=1;
 ELSE IF '01NOV2000'D <= startd <= '31OCT2001'D THEN start_P=2;
 ELSE IF '01NOV2001'D <= startd <= '31JAN2002'D THEN start_P=3;
 ELSE IF '01FEB2002'D <= startd <= '30APR2002'D THEN start_P=4;
 ELSE IF '01MAY2002'D <= startd <= '30APR2003'D THEN start_P=5;
 ELSE IF '01MAY2003'D <= startd <= '30APR2004'D THEN start_P=6;

 ELSE START_P=.;

 IF stopd<'01NOV1999'D THEN STOP_P=0;
 ELSE IF '01NOV1999'D <= STOPd <= '31OCT2000'D THEN STOP_P=1;
 ELSE IF '01NOV2000'D <= STOPd <= '31OCT2001'D THEN STOP_P=2;
 ELSE IF '01NOV2001'D <= STOPd <= '31JAN2002'D THEN STOP_P=3;
 ELSE IF '01FEB2002'D <= STOPd <= '30APR2002'D THEN STOP_P=4;
 ELSE IF '01MAY2002'D <= STOPd <= '30APR2003'D THEN STOP_P=5;
 ELSE IF '01MAY2003'D <= STOPd <= '30APR2004'D THEN STOP_P=6;
 ELSE STOP_P=.;
;


 -------------------------------------------------------------------------*
    3. Exclude records which started filling drug in baseline period
       and also stopped in the baseline period;
-------------------------------------------------------------------------*;
:a days;
  set days;
  if start_p=0 and stop_p=0 then delete;
;


-------------------------------------------------------------------------------------*
 Step two: Make adjustment to those records with start_p^=stop_p
        1. Split one record into several records:
           e.g. If a patient started filling the prescription in period 1
                and stopped in period 3, then this 1 row of record was
                splitted into 3 rows as follows:

           row 1: started from original start_date, and ended till last date of period 1
           row 2: started from the first date of period 2, and ended till the
                  last date of period2
           row 3: started from the first date of period 3, and ended at the
```

```
                original stop_date
-------------------------------------------------------------------------------------------------*;
ata days_update;
   set days;
   where start_p^=stop_p;

       if start_p=0 then do;
           if stop_p=1 then do;
               start_date1='01nov1999'd;
               start_p1=1;
               stop_date1=stop_date;
               stop_p1=stop_p;
               output;
           end;
           else if stop_p=2 then do;
               start_date1='01nov1999'd;
               start_p1=1;
               stop_date1='31oct2000'd;
               stop_p1=1;
               output;
               start_date1='01nov2000'd;
               start_p1=2;
               stop_date1=stop_date;
               stop_p1=stop_p;
               output;
           end;
           else if stop_p=3 then do;
               start_date1='01nov1999'd;
               start_p1=1;
               stop_date1='31oct2000'd;
               stop_p1=1;
               output;
               start_date1='01nov2000'd;
               start_p1=2;
               stop_date1='31oct2001'd;
               stop_p1=2;
               output;
               start_date1='01nov2001'd;
               start_p1=3;
               stop_date1=stop_date;
               stop_p1=stop_p;
               output;
           end;
           else if stop_p=4 then do;
               start_date1='01nov1999'd;
               start_p1=1;
               stop_date1='31oct2000'd;
               stop_p1=1;
               output;
               start_date1='01nov2000'd;
               start_p1=2;
               stop_date1='31oct2001'd;
               stop_p1=2;
               output;
               start_date1='01nov2001'd;
```

```
    start_p1=3;
    stop_date1='31jan2002'd;
    stop_p1=3;
    output;
    start_date1='01feb2001'd;
    start_p1=4;
    stop_date1=stop_date;
    stop_p1=stop_p;
    output;
end;
else if stop_p=5 then do;
    start_date1='01nov1999'd;
    start_p1=1;
    stop_date1='31oct2000'd;
    stop_p1=1;
    output;
    start_date1='01nov2000'd;
    start_p1=2;
    stop_date1='31oct2001'd;
    stop_p1=2;
    output;
    start_date1='01nov2001'd;
    start_p1=3;
    stop_date1='31jan2002'd;
    stop_p1=3;
    output;
    start_date1='01feb2001'd;
    start_p1=4;
    stop_date1='30apr2002'd;
    stop_p1=4;
    output;
    start_date1='01may2002'd;
    start_p1=5;
    stop_date1=stop_date;
    stop_p1=stop_p;
    output;
end;
else if stop_p=6 then do;
    start_date1='01nov1999'd;
    start_p1=1;
    stop_date1='31oct2000'd;
    stop_p1=1;
    output;
    start_date1='01nov2000'd;
    start_p1=2;
    stop_date1='31oct2001'd;
    stop_p1=2;
    output;
    start_date1='01nov2001'd;
    start_p1=3;
    stop_date1='31jan2002'd;
    stop_p1=3;
    output;
    start_date1='01feb2001'd;
    start_p1=4;
```

```
        stop_date1='30apr2002'd;
        stop_p1=4;
        output;
        start_date1='01may2002'd;
        start_p1=5;
        stop_date1='30apr2003'd;
        stop_p1=5;
        output;
        start_date1='01may2003'd;
        start_p1=6;
        stop_date1=stop_date;
        stop_p1=stop_p;
        output;
    end;
end;
if start_p=1 then do;
    if stop_p=2 then do;
        start_date1=start_date;
        start_p1=start_p;
        stop_date1='31oct2000'd;
        stop_p1=1;
        output;
        start_date1='01nov2000'd;
        start_p1=2;
        stop_date1=stop_date;
        stop_p1=stop_p;
        output;
    end;
    else if stop_p=3 then do;
        start_date1=start_date;
        start_p1=start_p;
        stop_date1='31oct2000'd;
        stop_p1=1;
        output;
        start_date1='01nov2000'd;
        start_p1=2;
        stop_date1='31oct2001'd;
        stop_p1=2;
        output;
        start_date1='01nov2001'd;
        start_p1=3;
        stop_date1=stop_date;
        stop_p1=stop_p;
        output;
    end;
    else if stop_p=4 then do;
        start_date1=start_date;
        start_p1=start_p;
        stop_date1='31oct2000'd;
        stop_p1=1;
        output;
        start_date1='01nov2000'd;
        start_p1=2;
        stop_date1='31oct2001'd;
```

```
    output;
    start_date1='01nov2001'd;
    start_p1=3;
    stop_date1='31jan2002'd;
    stop_p1=3;
    output;
    start_date1='01feb2002'd;
    start_p1=4;
    stop_date1=stop_date;
    stop_p1=stop_p;
    output;
end;
else if stop_p=5 then do;
    start_date1=start_date;
    start_p1=start_p;
    stop_date1='31oct2000'd;
    stop_p1=1;
    output;
    start_date1='01nov2000'd;
    start_p1=2;
    stop_date1='31oct2001'd;
    stop_p1=2;
    output;
    start_date1='01nov2001'd;
    start_p1=3;
    stop_date1='31jan2002'd;
    stop_p1=3;
    output;
    start_date1='01feb2002'd;
    start_p1=4;
    stop_date1='30apr2002'd;
    stop_p1=4;
    output;
    start_date1='01may2002'd;
    start_p1=5;
    stop_date1=stop_date;
    stop_p1=stop_p;
    output;
end;
else if stop_p=6 then do;
    start_date1=start_date;
    start_p1=start_p;
    stop_date1='31oct2000'd;
    stop_p1=1;
    output;
    start_date1='01nov2000'd;
    start_p1=2;
    stop_date1='31oct2001'd;
    stop_p1=2;
    output;
    start_date1='01nov2001'd;
    start_p1=3;
    stop_date1='31jan2002'd;
    stop_p1=3;
    output;
```

```
        start_date1='01feb2002'd;
        start_p1=4;
        stop_date1='30apr2002'd;
        stop_p1=4;
        output;
        start_date1='01may2002'd;
        start_p1=5;
        stop_date1='30apr2003'd;
        stop_p1=5;
        output;
        start_date1='01may2003'd;
        start_p1=6;
        stop_date1=stop_date;
        stop_p1=stop_p;
        output;
    end;
end;
if start_p=2 then do;
    if stop_p=3 then do;
        start_date1=start_date;
        start_p1=start_p;
        stop_date1='31oct2001'd;
        stop_p1=2;
        output;
        start_date1='01nov2001'd;
        start_p1=3;
        stop_date1=stop_date;
        stop_p1=stop_p;
        output;
    end;
    else if stop_p=4 then do;
        start_date1=start_date;
        start_p1=start_p;
        stop_date1='31oct2001'd;
        stop_p1=2;
        output;
        start_date1='01nov2001'd;
        start_p1=3;
        stop_date1='31jan2001'd;
        stop_p1=3;
        output;
        start_date1='01feb2002'd;
        start_p1=4;
        stop_date1=stop_date;
        stop_p1=stop_p;
        output;
    end;
    else if stop_p=5 then do;
        start_date1=start_date;
        start_p1=start_p;
        stop_date1='31oct2001'd;
        stop_p1=2;
        output;
        start_date1='01nov2001'd;
```

```
        stop_date1='31jan2001'd;
        stop_p1=3;
        output;
        start_date1='01feb2002'd;
        start_p1=4;
        stop_date1='30apr2002'd;
        stop_p1=4;
        output;
        start_date1='01may2002'd;
        start_p1=5;
        stop_date1=stop_date;
        stop_p1=stop_p;
        output;
    end;
    else if stop_p=6 then do;
        start_date1=start_date;
        start_p1=start_p;
        stop_date1='31oct2001'd;
        stop_p1=2;
        output;
        start_date1='01nov2001'd;
        start_p1=3;
        stop_date1='31jan2001'd;
        stop_p1=3;
        output;
        start_date1='01feb2002'd;
        start_p1=4;
        stop_date1='30apr2002'd;
        stop_p1=4;
        output;
        start_date1='01may2002'd;
        start_p1=5;
        stop_date1='30apr2003'd;
        stop_p1=5;
        output;
        start_date1='01may2003'd;
        start_p1=6;
        stop_date1=stop_date;
        stop_p1=stop_p;
        output;
    end;
end;
if start_p=3 then do;
    if stop_p=4 then do;
        start_date1=start_date;
        start_p1=start_p;
        stop_date1='31jan2002'd;
        stop_p1=3;
        output;
        start_date1='01feb2002'd;
        start_p1=4;
        stop_date1=stop_date;
        stop_p1=stop_p;
        output;
    end;
```

```
    else if stop_p=5 then do;
        start_date1=start_date;
        start_p1=start_p;
        stop_date1='31jan2002'd;
        stop_p1=3;
        output;
        start_date1='01feb2002'd;
        start_p1=4;
        stop_date1='30apr2002'd;
        stop_p1=4;
        output;
        start_date1='01may2002'd;
        start_p1=5;
        stop_date1=stop_date;
        stop_p1=stop_p;
        output;
    end;
    else if stop_p=6 then do;
        start_date1=start_date;
        start_p1=start_p;
        stop_date1='31jan2002'd;
        stop_p1=3;
        output;
        start_date1='01feb2002'd;
        start_p1=4;
        stop_date1='30apr2002'd;
        stop_p1=4;
        output;
        start_date1='01may2002'd;
        start_p1=5;
        stop_date1='30apr2003'd;
        stop_p1=5;
        output;
        start_date1='01may2003'd;
        start_p1=6;
        stop_date1=stop_date;
        stop_p1=stop_p;
        output;
    end;
end;
if start_p=4 then do;
    if stop_p=5 then do;
        start_date1=start_date;
        start_p1=start_p;
        stop_date1='30apr2002'd;
        stop_p1=4;
        output;
        start_date1='01may2002'd;
        start_p1=5;
        stop_date1=stop_date;
        stop_p1=stop_p;
        output;
    end;
    else if stop_p=6 then do;
        start_date1=start_date;
```

```
            start_p1=start_p;
            stop_date1='30apr2002'd;
            stop_p1=4;
            output;
            start_date1='01may2002'd;
            start_p1=5;
            stop_date1='30apr2003'd;
            stop_p1=5;
            output;
            start_date1='01may2003'd;
            start_p1=6;
            stop_date1=stop_date;
            stop_p1=stop_p;
            output;
        end;
    end;
    if start_p=5 then do;
        start_date1=start_date;
        start_p1=start_p;
        stop_date1='30apr2003'd;
        stop_p1=5;
        output;
        start_date1='01may2003'd;
        start_p1=6;;
        stop_date1=stop_date;
        stop_p1=stop_p;
        output;
    end;
    if start_p=6 then do;
        start_date1=start_date;
        start_p1=6;
        stop_date1='30apr2004'd;
        stop_p1=6;
        output;
    end;
 format start_date1 stop_date1 mmddyy10.;
;

a days_update;
 set days_update(drop=startd stopd start_p stop_p);
 rename start_date1=startd
        stop_date1=stopd
        start_p1=start_p
        stop_p1=stop_p;
1;


-------------------------------------------------------------------------*
      2. Create new data set by combining the newly
         adjusted records with those who had started filling
         prescription and ended in the same period (start_p=stop_p);
-------------------------------------------------------------------------*;
:a post;
 set days;
 where start p=stop p;
```

```
n;
ata days;
   set post days_update;
un;

roc sql;
 select count(distinct fake_patient)
 from days;
uit; /* 6314 */


roc sort data=days; by fake_patient va_classification startd; run;
roc sort data=days; by uniqid; run;

lata days;
   set days;
   indxdt='01nov1999'd;
   indxdt_end='30apr2004'd;
   format indxdt indxdt_end mmddyy10.;
un;

lata days;
   set days;
   by uniqid;

   fake_patient2=put(fake_patient,7.);

   format indxdt indxdt_end mmddyy10.;

       array rx_all_(*) 3 rx1 - rx1643;
       retain rx1 - rx1643;

       if first.uniqid then do;
           do i= 1 to 1643;
               rx_all_(i) = 0;
           end;
       end;

       if indxdt <= startd<= indxdt_end then do;
           day_ptr = startd - indxdt + 1;
       end;

       if day_ptr >0 then do i = day_ptr to min(sum(day_ptr,suppdays)-1,1643);
           rx_all_(i) = 1;
       end;

       if last.uniqid then output;

   keep fake_patient fake_patient2 rx1 - rx1643 va_classification;
un;


*-------------------------------------------------------------------------*
        3. Sum all filled days of each CV class by each patient;
*-------------------------------------------------------------------------*;
```

```
c means data=days noprint;
 class fake_patient;
 var rx1 - rx1643;
 output out=days2 sum=;
;

a days2;
 set days2;
 where fake_patient^=.;
 fake_patient2='T'||compress(put(fake_patient,20.));
 drop _type_ _freq_ fake_patient;
;

c sql;
lect count(distinct fake_patient2)
om days2
ere substr(fake_patient2,1,1)='T';
t; /* 6314 */

a final;
 set days(drop=fake_patient) days2;
 array ct_rx(1643) rx1 - rx1643;
 do i=1 to 1643;
     if ct_rx(i)>=1 then ct_rx(i)=1;
     else ct_rx(i)=0;
 end;
 drop i;
;

c sql;
lect count(distinct fake_patient2)
om final
ere substr(fake_patient2,1,1)='T';
t; /* 2967 */ /*problem*/



----------------------------------------------------------------*;
tep four: Carry over days from baseline period 0                *;
        1. If a patient didn't have drug use in the baseline
           period, then the start_date=the 1st filled date in
           period 1;
        2. If a patient had drug usage in the baseline period,
           then the start_date=the 1st date of period 1 (11/1/1999);

ote: This step is not necessary for MPR numerator, but written for
     GAP measure.
----------------------------------------------------------------*;
a gap;
 set final;
 where fake_patient2=:'T';
 drop va_classification;
; /* 6314 obs, but duplicated fake_patient2 */

c sql;
lect count(distinct fake_patient2)
```

```
rom gap;
uit; /* 2967 */ /* problem */


roc sql;
 select distinct fake_patient2
 from final
 where fake_patient2='T1000';
uit; /* yes */


roc sort data=gap; by fake_patient2; run;

roc sql;
 select count(distinct fake_patient2)
 from gap;
uit; /* 2967 */ /* problem*/



roc transpose data=gap out=gap prefix=v;
    by fake_patient2;
    var rx1 - rx1643;
un;

roc sql;
 select count(distinct fake_patient2)
 from gap;
uit; /* 2967 */ /* problem */

roc sort data=gap; by fake_patient2; run;

ata gap;
    set gap;
    by fake_patient2;
    if first.fake_patient2 then v2=0;
    v2+v1;
un;

roc sql;
 select count(distinct fake_patient2)
 from gap;
uit; /* 2967 */


ata gap;
    set gap;
    if v2=1 then marker=substr(_NAME_,3)*1;
un;

ata marker;
    set gap;
    where marker^=.;
    fake_patient=substr(fake_patient2,2)*1;
    if marker>366 then do;
```

```
      marker1=366;
      marker2=(marker-1)-366;
      if (marker-1)-366>365 then do;
          marker1=366;
          marker2=365;
          marker3=(marker-1)-366-365;
          if (marker-1)-366-365>92 then do;
              marker1=366;
              marker2=365;
              marker3=92;
              marker4=(marker-1)-366-365-92;
              if (marker-1)-366-365-92>89 then do;
                  marker1=366;
                  marker2=365;
                  marker3=92;
                  marker4=89;
                  marker5=(marker-1)-366-365-92-89;
                  if (marker-1)-366-365-92-89>365 then do;
                      marker1=366;
                      marker2=365;
                      marker3=92;
                      marker4=89;
                      marker5=365;
                      marker6=(marker-1)-366-365-92-89-265;
                  end;
              end;
          end;
      end;
 end;
 else do;
      marker1=marker-1;
      marker2=0;
      marker3=0;
      marker4=0;
      marker5=0;
      marker6=0;
 end;
 keep fake_patient marker1-marker6 marker;
;

a marker;
 set marker;
 array mk(6) marker1-marker6;
 do i=1 to 6;
      if mk(i)=. then mk(i)=0;
      else mk(i)=mk(i);
 end;
 drop i;
;
c sort data=marker nodupkey; by fake_patient; run;

a gap;
 set gap;
 if v2=0 then v3=.;
 else v3=v1;
```

```
    drop v1 v2 marker;
un;

roc transpose data=gap out=gap;
    by fake_patient2;
    var v3;
un;

ata gap;
    set gap;
    fake_patient=substr(fake_patient2,2)*1;
    drop _name_;
un;
roc sort data=gap; by fake_patient; run;

ata gap_final;
    merge gap marker;
    by fake_patient;
un;

ata gap_final;
    set gap_final;
    array ct_rx(1643) rx1 - rx1643;
    do i=1 to 1643;
        if ct_rx(i)>=1 then ct_rx(i)=1;
        else ct_rx(i)=0;
    end;
    drop i;
un;


-------------------------------------------------------------------*;
  Step five: Sum gap days by periods (pre, middle and post)        *;
             and create numerator variables for each period.       *;
-------------------------------------------------------------------*;
ata p1;
    set gap_final;
    tdsupp1=sum(of rx1-rx366);
    if marker1^=0 then GAP_NUM1=366-marker1-tdsupp1;
    else GAP_NUM1=366-tdsupp1;
    keep fake_patient tdsupp1 gap_num1 marker1;
un;


ATA P2;
    set gap_final;
    TDSUPP2=SUM(OF RX367-RX731);
    if marker2^=0 then GAP_NUM2=365-marker2-TDSUPP2;
    else GAP_NUM2=365-TDSUPP2;
    keep fake_patient tdsupp2 gap_num2 marker2;
UN;

ATA P3;
    set gap_final;
    TDSUPP3=SUM(OF RX732-RX823);
```

```
 GAP_NUM3=92-TDSUPP3;
 keep fake_patient tdsupp3 gap_num3;
;

A P4;
 set gap_final;
 TDSUPP4=SUM(OF RX824-RX912);
 GAP_NUM4=89-TDSUPP4;
 keep fake_patient tdsupp4 gap_num4;
;

A P5;
 set gap_final;
 TDSUPP5=SUM(OF RX913-RX1277);
 GAP_NUM5=365-TDSUPP5;
 keep fake_patient tdsupp5 gap_num5;
;

A P6;
 set gap_final;
 TDSUPP6=SUM(OF RX1278-RX1643);
 GAP_NUM6=366-TDSUPP6;
 keep fake_patient tdsupp6 gap_num6;
;


*******************************;
ERGE PERIOD P1 TO P6 DATASETS *;
*******************************;

 SORT DATA=P1; BY FAKE_PATIENT; RUN;
 SORT DATA=P2; BY FAKE_PATIENT; RUN;
 SORT DATA=P3; BY FAKE_PATIENT; RUN;
 SORT DATA=P4; BY FAKE_PATIENT; RUN;
 SORT DATA=P5; BY FAKE_PATIENT; RUN;
 SORT DATA=P6; BY FAKE_PATIENT; RUN;

A statin.GM_NUM;
 MERGE P1 P2 P3 P4 P5 P6;
 BY FAKE_PATIENT;
 gap_num_pre=sum(gap_num1,gap_num2);
 gap_num_m=sum(gap_num3,gap_num4);
 gap_num_post=sum(gap_num5,gap_num6);
 keep FAKE_PATIENT gap_num_pre gap_num_m gap_num_post;
;

 sql;
lect count(distinct fake_patient)
m statin.GM_NUM;
t; /* 6314 */
```