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%macro _mergeadpc;
* code is based on pkmerge being produced prior to ADPC;
data adpc;
    set sdtm.pc(where=(pctestcd='NIC')); * cotinine not required for pk
group;
    length avalc units $20. param $120.;

    *results;
    aval=pcstresn;
    avalc=pcstresc;
    units=pcstresu;

    *parameter category;
    if not missing(pcstresu) then param=trim(pctest) ||'
(|||trim(pcstresu)|||)';
    else param=trim(pctest) ||' (ng/mL)'; * code in missing for transpose
;
    paramcd=pctestcd;

    if pctestcd='NIC' then
        paramn=1;
    else if pctestcd='COT' then
        paramn=2;
    else put 'PCTEST not recognised : ' pctestcd=;

    *treatment period;
    if visit in ('DAY 1' 'DAY 2') then
        aperiod=1;
    else if visit in ('DAY 3' 'DAY 4/DISCHARGE') then
        aperiod=2;

    *blq flag;
    if index(pcorres,'BLQ') then
        do;
            blqfl='Y';
            blqfn=1;
            aval=pclloq/2;
        end;

    *test date and time;
    format adt date9. atm tod8. adtc $10. atmc $8.;
    adtc=compress(scan(pcdtc,1,'T'));
    atmc=compress(scan(pcdtc,2,'T'));
    adt=input(adtc,ymmdd10.);

    if length(atmc)=5 then atm=input(atmc,time5.)+'00:00:30't;*re merge
instructions;
    else atm=input(atmc,time8.);

    *visits and timepoints;
    length avisit atpt $40 avisitn atptn ntime 8.;
    avisit=propcase(visit);
    avisitn=visitnum;

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if upcase(pctpt)=:'WITHIN' then do;
    atpt='15 min < T0';
    atptn=0;
    ntime=0;
end;
else if compress(upcase(pctpt))='2MIN' then do;
    atpt='T0 + 2 min';
    atptn=1;
    ntime=2;*round(2/60,0.0001); /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='4MIN' then do;
    atpt='T0 + 4 min';
    atptn=2;
    ntime=4;*round(4/60,0.0001); /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='6MIN' then do;
    atpt='T0 + 6 min';
    atptn=3;
    ntime=6;*round(6/60,0.0001); /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='8MIN' then do;
    atpt='T0 + 8 min';
    atptn=4;
    ntime=8;*round(8/60,0.0001); /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='10MIN' then do;
    atpt='T0 + 10 min';
    atptn=5;
    ntime=10;*round(10/60,0.0001); /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='15MIN' then do;
    atpt='T0 + 15 min';
    atptn=6;
    ntime=15;*round(15/60,0.0001); /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='20MIN' then do;
    atpt='T0 + 20 min';
    atptn=7;
    ntime=20;*round(20/60,0.0001); /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='25MIN' then do;
    atpt='T0 + 25 min';
    atptn=8;
    ntime=25;*round(25/60,0.0001); /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='30MIN' then do;
    atpt='T0 + 30 min';
    atptn=9;
    ntime=30;*round(30/60,0.0001); /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='35MIN' then do;
    atpt='T0 + 35 min';
    atptn=10;

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        ntime=35;*round(35/60,0.0001); /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='40MIN' then do;
    atpt='T0 + 40 min';
    atptn=11;
    ntime=40;*round(40/60,0.0001); /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='45MIN' then do;
    atpt='T0 + 45 min';
    atptn=12;
    ntime=45;*45/60; /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='1H' then do;
    atpt='T0 + 60 min';
    atptn=13;
    ntime=1*60; /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='2H' then do;
    atpt='T0 + 2 h';
    atptn=14;
    ntime=2*60; /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='3H' then do;
    atpt='T0 + 3 h';
    atptn=15;
    ntime=3*60; /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='4H' then do;
    atpt='T0 + 4 h';
    atptn=16;
    ntime=4*60; /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='6H' then do;
    atpt='T0 + 6 h';
    atptn=17;
    ntime=6*60; /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='9H' then do;
    atpt='T0 + 9 h';
    atptn=18;
    ntime=9*60; /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='12H' then do;
    atpt='T0 + 12 h';
    atptn=19;
    ntime=12*60; /* 3) SM 23May2014 */
end;
else if compress(upcase(pctpt))='24H' then do;
    atpt='T0 + 24 h';
    atptn=20;
    ntime=24*60; /* 3) SM 23May2014 */
end;
else put 'Check PCTPT as unable to map: ' avisit= pctpt=;

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    * PK Day;
    pkday=1; * within period;
    aday=pcdy;

    keep studyid usubjid pcseq pcspec pcstat pcreasnd param: avisit:
    atpt: pkday aperiod aval: aday blq: pcdtc adtc atmc adt atm
        ntime pcorres pclloq units;
run;

/*merge with adsl to get demographic and treatment related variables*/
proc sort data=adpc;
    by studyid usubjid;
run;

proc sort data=adam.adsl out=adsl;
    by studyid usubjid;
run;

data pcl;
    merge adsl adpc(in=a);
    by studyid usubjid;
    if a;

    * determine dose time by period;
    format dosed datetimel6.;

    * treatment variables ;
    if aperiod=1 then do;
        dosed=tr01sdtm;
        trta=trt01a;
        trtan=trt01an;
        trtp=trt01p;
        trtpn=trt01pn;
    end;
    else if aperiod=2 then do;
        dosed=tr02sdtm;
        trta=trt02a;
        trtan=trt02an;
        trtp=trt02p;
        trtpn=trt02pn;
    end;
    else put 'treatment not recognised : ' subjidn=;
run;

data pc2a;
    set pcl;

    if randfl='N' then delete; *only randomised population;

    * determine actual time post dose ;
    format drawn datetimel6.;

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/* QADPC 13) - JH 07AUG2014 */
LENGTH _PCDTC $200;
_PCDTC = PCDTC;
if not missing(_pcdtc) then drawn=input(_pcdtc,e8601dt.);

*Create missing sample data/time and missing dose data/time
flags;
if missing(dosed) then mddtfl='Y';

if missing(drawn) or missing(pcdtc) then msdtfl='Y';

*calculate actual time postdose;
if not missing(dosed) and not missing(drawn) then
pactime=round((drawn-dosed)/(60/**60*/),0.0001); /* 3) SM 23May2014 */

* make any corrections for BST/DST ;
format bst2013 dst2013 datetime13. sdate wdate date9. gstime
gettime time5.;

* time of start of day light saving #place #year specific for
#study;
* otherwise set to early fictitious dates ;
sdate='01JAN1990'd; * BST ;
wdate='01DEC1990'd; * DST ;

gstime='02:00:00'T;
gettime='02:00:00'T;
bst2013=(sdate*24*60*60)+gstime;
dst2013=(wdate*24*60*60)+gstime;

if not missing(dosed) then do;
    if drawn>bst2013 and dosed<bst2013 then do;
        * if assay time after gmt time and dosed prior to
gmt time then decrease time by 1 hour ;
        clockfl='Y';
        pactime=pactime-1*60; /* 3) SM 23May2014 */
    end;
    else if drawn>dst2013 and dosed<dst2013 then do;
        * if assay time after gmt time and dosed prior to
gmt time then increase time by 1 hour;
        clockfl='Y';
        pactime=pactime+1*60; /* 3) SM 23May2014 */
    end;
    else clockfl=' ';
end;

run;

data pc2;
set pc2a;

*calculate deviation and derive deviation flag;
attrib devn pctdev length=8;

if ntime > 0 then do;

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        if not missing(pactime) and not missing(ntime) then do;
            ddevn=(pactime-ntime); * in hours for below;
            *devn=(pactime-ntime)*60; * in minutes for client; /* 3) SM
23May2014 */
            DEVN=ROUND(PACTIME-NTIME,0.001); * NOW IN MINUTES; /* 3) SM
23May2014 */
            pctdev=(ddevn*100)/ntime;
        end;
    end;

    * set negative pactime values to 0 at predose ;
    if index(atpt,'15 min < T0') then do;
        *devn=(pactime-ntime)*60; /* 3) SM 23May2014 */
        DEVN=ROUND(PACTIME-NTIME,0.001); /* 3) SM 23May2014 */
        pctdev=.;
    end;

    *Create PKDACTIM same as PACTIME. May need to alter at later stage ;
    format pkdactim 8./*8.4*/; /* 3) SM 23May2014 */
    if atptn=0 then pkdactim=0;
    else pkdactim=pactime*60/**60*/; /* NOW IN SECONDS 3) SM 23May2014 */
/* 5) SM 29May2014 */
run;

* analysis values and flags for PK MERGE dataset;
*study specific code below about handling BLQ values ;
*Identify the BLQ value;
data pc3 blqs;
    set pc2;
    keep subjidn paramn atptn aperiod aval;
    if missing(blqfl) and not missing(aval) then output pc3;
    if not missing(blqfl) then output blqs;
run;

/* find last blq */
proc sort data=blqs out=lblq(rename=(atptn=lblqtm));
    by subjidn aperiod paramn atptn;
run;

data lblq2;
    set lblq(where=(lblqtm gt 1)) ;* for 106326 by inspection of times
early blq between 0 and 1 ;
    by subjidn aperiod paramn lblqtm;

    check=1;
    if first.aperiod then fblqtm=lblqtm;
    retain fblqtm;
    check2=lag(check);
    checktm=lag(lblqtm);
    if (check2=1 and check=1) and (lblqtm=checktm+1) then output; /* 2
consecutive blq values after profile started */
run;

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data lblq3;
    set lblq2;
    by subjidn aperiod paramn lblqtm;

    if last.aperiod ; /* assumption made that profile is single phase
and does not rise significantly */

    keep subjidn aperiod paramn lblqtm fblqtm;
run;

*Sort ;
proc sort data=pc3;
    by subjidn aperiod paramn atptn;
run;

*Take the first reading which is above BLQ and rename to first visit for
quantifiable values;
data pc3a;
    set pc3;
    by subjidn aperiod paramn atptn;

    if first.paramn;
    rename atptn=avisitnf;
    drop aval;
run;

/*Take the last reading which is above BLQ and rename to last visit for
quantifiable values*/
data pc3b;
    set pc3;
    by subjidn aperiod paramn atptn;
    lval=lag(atptn);

    if last.paramn; * last measureable value in a profile;
    rename atptn=avisitnl;
    drop aval;
run;

/*Sort the original dataset*/
proc sort data=pc2;
    by subjidn aperiod paramn atpt;
run;

*Merge + Assign 0 and missing value and blq flags;
data pc4;
    merge pc2(in=a) pc3a(in=b) pc3b(in=c) lblq3;
    by subjidn aperiod paramn;
    laval=lag(aval);
    pklevel=aval;

    *Create blq flags;

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        if ((not missing(avisitnl) and (atptn ge avisitnl)) or (fblqtm le
atptn le lblqtm)) and blqfl='Y' then do;
            pklevel=.;
            tblqfl='Y';
        end;*trailing blq flag at end of profile;

        if atptn=0 and blqfl='Y' then pklevel=0;  * re pk merge dataset
instructions for <T0;

        if index(atpt,'15 min < T0') and aval gt 0 and missing(blqfl) then
ppdosfl='Y'; *Positive value at pre-dose;

        if a and not b then fpblqfl='Y'; *full profile blq flag;

            if (atptn gt avisitnf) and (atptn le avisitnl) and blqfl='Y'
and missing(tblqfl) then do;
                eblqfl='Y';
            end; *Embedded blq flag ;

            * have non blq, quantifiable value that occurs after 2 blq
values that have occurred after 2 min for 106326 ;
            if missing(blqfl) and aval gt 0 and (not missing(lblqtm) and
atptn gt lblqtm) then do;
                pklevel=.;
                lposfl='Y';
            end;*Late positive flag;
        * specific code for 106326 please remove if not this study;
        if subjidn=129 and aday=3 then do;
            if ntime in (45 240)/(0.75 4)* then do; /* 3) SM
23May2014 */
                pklevel=aval;
                tblqfl=' ';
                eblqfl='Y';
            end;
        end;

run;

proc sort data=pc4;
    by subjidn aperiod paramn avisitn;
run;

* find missing value reasons;
proc sort data=pc4(where=(not missing(pcstat))) out=reasnd(keep=pcreasnd)
nodupkey;
    by pcreasnd;
run;

data pc4a;
    set pc4;
    by subjidn aperiod paramn avisitn;
    * No result / missing sample flag ;

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        if pcreasnd in ('IVR' 'NOT REPORTABLE' 'FAILED ANALYTICAL
INVESTIGATION' 'SVD' 'SVD-NICOTINE' 'SVD-COTININE') then nrfl='Y';
        else if not missing(pcreasnd) then misssfl='Y';

        if not missing(devn) then do;
            if trta='NRT gum' THEN DO;
                if (ntime le 0 and not (-15 le devn le 0)) or (0 lt ntime le
45/*(45/60)*/ and devn gt 1) or
                (ntime=1 and devn gt 3) or (2*60 le ntime le 24*60 and devn gt 5)
then do; /* 3) SM 23May2014 */
                    devnfl='Y';
                    end; *deviation flag;
                end;
            else do;
                if (ntime le 0 and not (-15 le devn le 0)) or (0 lt ntime le
10/*round(10/60,0.0001)*/ and devn gt 1) or
                (/*(15/60)*/15 le ntime le 45/*(45/60)*/ and devn gt 2) or
                (ntime=1*60 and devn gt 3) or
                (2*60 le ntime le 24*60 and devn gt 5) then do; /* 3) SM
23May2014 */
                    devnfl='Y';
                    end; *deviation flag;
                end;
            if ntime ne 0 and devn lt 0 and not missing(pcorres) then
devnfl='Y'/*'y'*/; /* 4) SM 23May2014 */
            end;

        if complfl = 'N' then withdfl='Y'; *withdrawn flag;
run;

data pc5;
    set pc4a;
run;

*Merge with EX dataset to get dose and dose unit;
data ex;
    merge adam.adex(where=(randfl='Y' and epoch in ('PRODUCT USE 1'
'PRODUCT USE 2'))) in=a)
            sdtm.ex(where=(epoch in ('PRODUCT USE 1' 'PRODUCT USE
2')))keep=usubjid exdose exdosu epoch);
    by usubjid epoch;
    if a;
    length nicu $8.;
    nicdose=aval;
    nicu=avalu;
    aday=astday;
    keep usubjid exdose exdosu nicdose nicu aday aperiod;
run;

data dx;
    merge adam.addx(where=(randfl='Y' and epoch in ('PRODUCT USE 1'
'PRODUCT USE 2'))) in=a)

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        sdtm.dx(where=(epoch in ('PRODUCT USE 1' 'PRODUCT USE
2'))keep=usubjid dxdose dxdosu epoch);
        by usubjid epoch;
        if a;
        length nicu $8.;
        nicdose=aval;
        nicu=avalu;
        aday=astday;
        keep usubjid dxdose dxdosu nicdose nicu aday aperiod;
run;

data ex1a;
    set ex dx;
run;

proc sort data=ex1a;
    by usubjid aperiod aday;
run;

*keep one observation per subject in each period;
data ex2;
    set ex1a;
    by usubjid aperiod aday;

    if first.aday;
    /* Make sure merges onto Day 2 and 4 as well specific to PK studies
*/
    output;
    aday+1;
    output;
run;

proc sort data=pc5;
    by usubjid aperiod aday;
run;

data pc6;
    merge pc5(in=a) ex2;
    by usubjid aperiod aday;

    if a;
run;

data pc7;
    set pc6;
    by usubjid aperiod pkday;

    *create pk merge specific variable;
    dosetime=0;
    IF AVAL NE PKLEVEL THEN AVAL=PKLEVEL;    /* 2) SM 23May2014 */
run;

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* add onto library dataset ;
data final;
    set stdlib.pkmerge pc7;
run;

/* create final dataset */
options replace;

proc sql;
    create table pkmerge (label='Pharmacokinetic concentrations') as
        select studyid, usubjid, subjidn, siteid,
            weightbl, pcseq, param, paramcd, paramn, units, pcspec,
pcstat, pcreasnd ,
            avisit, avisitn, atpt, atptn, pkday, aperiod, ntime, pactime,
pkdactim, pcorres, aval, avalc, pklevel,
            fpblqfl, tblqfl, eblqfl, lposfl, ppdosfl, clockfl, devn,
pctdev, devnfl, anomfl, misssfl, nrfl,
            withdfl, aday, blqfl, blqfn, nicdose, nicu,exdose, exdosu,
pclloq, pcdtc, msdtfl, mddtfl,
            trtp, trtpn, trta, trtan, trtseqp, trtseqpn, trtsega,
trtseqan
        from final
        order by usubjid, aperiod, paramn, avisitn, atptn;
quit;

%mend _mergeadpc;

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