

/\* MATCH ONE CASE WITH ONE OR SEVERAL CONTROL  
JANUARY 2008

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## MACRO VARIABLES

DATABASE : table which contains variable

SORTVAR : variable which identify each person

CASE : binary variable (0 or 1) which determines two groups

NBCTRL : maximal number of control per case

CRITERIA1-9 : criteria to take into account for the matching

CONDITION : condition to define for each matching with an "if function"

CASE\_UNMATCHED : name of the table which contains case unmatched at the end of the matching

SELECTION : name of the table which contains case and control with all variables at the end of the matching

CASECTRL : name of the table which contains case and control matched and strata at the end of the matching

Before using this macro, you have to :

- Prepare your database with only variables used during the matching (criteria and outcome variables)
- Compile the macro.
- Execute the macro :

Example :

```
%matching(database=pyo,sortvar=obs,case=cas,nbctrl=4,  
          criteria1=sexe,criteria2=dureesondageavantinfection,criteria3=age,criteria4=diab2,  
          criteria5=probsapsjcalc,criteria6=.,criteria7=.,criteria8=.,criteria9=.,  
          condition=%str(if (&criteria1=&criteria1.ctrl)and
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(&criteria3-10<&criteria3.ctrl<&criteria3+10) and
(&criteria2.ctrl>=&criteria2) and (&criteria4=&criteria4.ctrl)
and (&criteria5-0.10<&criteria5.ctrl<&criteria5+0.10)),
case_unmatched=case_unmatched,selection=selection,casectl=casectl);

```

You can see LOG screen for information of algorithm.

If you use this macro for work to be published please use the following citation:

Muriel Tafflet and Francois Adrien  
 Match one case with one or several control

```

*/
%macro MATCHING (database,sortvar,case,nbctrl,criteria1,criteria2,
                 criteria3,criteria4,criteria5,criteria6,criteria7,criteria8,criteria9,
                 condition,case_unmatched,selection,casectl);

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

/*we recover the number of cases*/
ods output onewayfreqs=fre(keep=frequency &case);
proc freq data=&database;tables &case;run;
data f;set fre;if &case=1;keep frequency;call symput('nbcas',frequency);run;

/** first step: creation of sort order according to difficulty of matching **/

/* for that we select all controls per case, and the same controls can be selected for several
cases*/

%sortorder;

/* creation of a database containing all cases which can't be match with a control */
proc sort data=selectiontot; by &sortvar; run;
data first; set selectiontot;by &sortvar;if first.&sortvar;run;
proc sort data=&database; by &sortvar; run;
data &case_unmatched; merge &database (in=a where=(&case=1)) first (in=b);by &sortvar;if
a and not b;run;

/* calculation of the frequency of controls per cases and frequency of cases per controls */
proc freq data=selectiontot order=freq noprint;
where &sortvar ne obsctrl;tables &sortvar / out=tab;tables obsctrl / out=tab2;run;

proc sort data=tab; by &sortvar;proc sort data=tab2; by obsctrl;
data &database.NV; merge tab (rename=(count=countcase) drop=percent) tab2
(rename=(obsctrl=&sortvar count=countctrl) drop=percent) &database;
by &sortvar;run;

/* calculation of the new number of cases to match */
proc means data=tab noprint;var &sortvar;output out=out n=n;run;
data _null_; set out;call symput('nbcas',n);run;

```

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/** 2nd step: selection of n controls per case **/

%selection;

%mend;

/** SUPPLEMENTARY macros **/

%macro sortorder();

/* database of the cases */
data Kleft; set &database;if &case=1;run;

/* database of the controls to match of one case */
data controls; set &database (where=(&case=0));
rename &sortvar=obsctrl &criteria1=&criteria1.ctrl; id=1;run;

%if &criteria2 ne . %then %do;
    data controls; set controls (rename=(&criteria2=&criteria2.ctrl));run;
%end;
%if &criteria3 ne . %then %do;
    data controls; set controls (rename=(&criteria3=&criteria3.ctrl));run;
%end;
%if &criteria4 ne . %then %do;
    data controls; set controls (rename=(&criteria4=&criteria4.ctrl));run;
%end;
%if &criteria5 ne . %then %do;
    data controls; set controls (rename=(&criteria5=&criteria5.ctrl));run;
%end;
%if &criteria6 ne . %then %do;
    data controls; set controls (rename=(&criteria6=&criteria6.ctrl));run;
%end;
%if &criteria7 ne . %then %do;
    data controls; set controls (rename=(&criteria7=&criteria7.ctrl));run;
%end;
%if &criteria8 ne . %then %do;
    data controls; set controls (rename=(&criteria8=&criteria8.ctrl));run;
%end;
%if &criteria9 ne . %then %do;
    data controls; set controls (rename=(&criteria9=&criteria9.ctrl));run;
%end;
/* loop on each case to match */

%do i=1 %to &nbcases;

/* database of case number i to match */
data caseni; set Kleft; if _N_=1;id=1;run;

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/* deleting of this case number i, to obtain the further case in the next step of the loop
*/
data Kleft; set Kleft;if _N_=1 then delete;run;

/* selection of all potential controls and case number i */
data controls1case; merge caseni (drop=&case) controls; by id;drop id;run;

/* selection of possible controls with the condition of the user */
data selection; set _last_;&condition;run;

/* set of the controls and cases selected in the current step with those of the previous
step*/
%if &i=1 %then %do;
    data selectiontot; set _last_;run;
    %end;
%else %do;
    data selectiontot; set selectiontot _last_; run;
%end;

%end; /* end of the loop */

%mend;

%macro selection();

/* preliminary step: we delete the cases and controls which couldn't be match
and sort the new table by frequency order of case and frequency order of controls */

data &database.NV; set &database.NV;
if countcase=. and &case=1 then delete; /* cases which can't be match */
if countctrl=. and &case=0 then delete; /* controls which can't be match */
run;
proc sort data=&database.NV; by countctrl countcase &sortvar; run; /* first we sort by
countctrl because it is missing values before */

title 'New cases and controls patients on which the macro will works:.';
title2 see table &database.NV;
proc freq;tables &case;run;

/* database with all controls and cases */
data KTleft; set &database.NV;run;

/* database with only cases */
data case; set &database.NV;if &case=1;run;

/* loop1: loop of number of controls wanted per case */

%do j=1 %to %eval(&nbctrl-1);

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%if &j>=2 %then %do;
    %let pas=%eval(&j-1);
    data selectionpasn&pas; set _last_;run;
%end;

/* database of the cases */
data Kleft; set case;run;

/* loop2: loop on each case */
%do i=1 %to &nbcase;

/* database of case number i to match */
data caseni; set Kleft;if _N_=1;id=1;run;

/* deleting of this case number i, to obtain the further case in the next step of
the loop */
data Kleft; set Kleft;if _N_=1 then delete;run;

/* database of the controls to match of one case */
data controls; set KTleft;rename &sortvar=obsctrl;id=1;run;

%if &criteria1 ne . %then %do;
    data controls; set controls (rename=(&criteria1=&criteria1.ctrl));run;
%end;
%if &criteria2 ne . %then %do;
    data controls; set controls (rename=(&criteria2=&criteria2.ctrl));run;
%end;
%if &criteria3 ne . %then %do;
    data controls; set controls (rename=(&criteria3=&criteria3.ctrl));run;
%end;
%if &criteria4 ne . %then %do;
    data controls; set controls (rename=(&criteria4=&criteria4.ctrl));run;
%end;
%if &criteria5 ne . %then %do;
    data controls; set controls (rename=(&criteria5=&criteria5.ctrl));run;
%end;
%if &criteria6 ne . %then %do;
    data controls; set controls (rename=(&criteria6=&criteria6.ctrl));run;
%end;
%if &criteria7 ne . %then %do;
    data controls; set controls (rename=(&criteria7=&criteria7.ctrl));run;
%end;
%if &criteria8 ne . %then %do;
    data controls; set controls (rename=(&criteria8=&criteria8.ctrl));run;
%end;
%if &criteria9 ne . %then %do;
    data controls; set controls (rename=(&criteria9=&criteria9.ctrl));run;
%end;
data controls1case; merge caseni (drop=&case) controls;by id;drop id;

```

```

        if &case=1 and &sortvar ne obsctrl then delete; /* we keep only the case
number i */run;

        /* selection of possible controls with the condition of the user */
        data selection; set _last_;&condition;run;

        /* selection of the first control of all possible controls: that why the sorting is
important*/

        proc sort; by &case;data last_selection; set _last_;if _N_=1;run;

        /* deletion of controls selected in the current step, in order to not select them
more than one times in the further steps */
        proc sort data=last_selection ; by obsctrl;
        proc sort data=KTleft; by &sortvar; run;
        data KTleft; merge last_selection (in=a keep=obsctrl
rename=(obsctrl=&sortvar)) KTleft (in=b);
        if b and not a; by &sortvar;run;

        proc sort data=KTleft;by countctrl countcase &sortvar;run;

        /* set of the controls and cases selected in the current step with those of the
previous step*/
        %if &i=1 %then %do;
            data selectiontot2; set last_selection;run;
            %end;
        %else %do;
            data selectiontot2; set selectiontot2 last_selection;run;
        %end;
    %end; /* end of loop2 */

%if &j>=2 %then %do;
    data selectiontot2; set selectiontot2 selectionpasn&pas;run;
    %end;
%end; /* end of loop1 */

title 'Number of cases unselected by the macro';
title2 see table &case_unmatched;

%if &nbctrl=2 %then %do;
    data &case_unmatched; set &case_unmatched selectiontot2
(where=(&sortvar=obsctrl));run;
    %end;
%else %if &nbctrl>2 %then %do;
    proc sort data=selectiontot2; by &sortvar;
    data temp; merge first (in=a) selectiontot2 (where=(&sortvar=obsctrl) in=b);by
&sortvar;if a and not b;run;
    data &case_unmatched; set &case_unmatched temp (where=(&sortvar=obsctrl));by
&sortvar;run;
%end;

```

```
proc freq;tables &case;run;

title Database of match cases and controls: &Selection;
title2 'Database with one line per patient, with the number of the stratum';
title3 and with status of the patient: &casectrl;

data &selection; set selectiontot2;where obsctrl ne &sortvar;run;
proc print noobs N='Number of match cases: ';var &sortvar obsctrl;run;

data temporaire; set &selection (keep=&sortvar obsctrl);retain suj id_strate 0;
if suj ne &sortvar then do;suj=&sortvar;id_strate=id_strate+1;end;run;

proc sort data=temporaire; by &sortvar;
data case; set temporaire (keep=&sortvar id_strate);by &sortvar;if
first.&sortvar;&case=1;run;

data control; set temporaire (keep=obsctrl id_strate rename=(obsctrl=&sortvar));&case=0;run;
data &casectrl; set case control;run;
proc sort data=&casectrl; by id_strate; run;
%mend;
```