**Residuals calculation using linear regression: Age + Age^2 + Edu\_cg**

proc reg data=np5;

model &y=agenp agenp\_sq nohsdeg somecoll collgrad;

output out=resid residual=resid\_&y;

run;

proc means data=resid mean std ;

var resid\_&y;

output out=rstat\_&y mean=mean\_resid\_&y std=std\_resid\_&y;

run;

data rstat2\_&y;

set rstat\_&y (drop= \_type\_ \_freq\_);

idtype=**1**;

run;

data resid2\_&y;

merge resid (keep=id idtype np\_date resid\_&y) rstat2\_&y ;

by idtype;

z\_resid\_&y=((resid\_&y - mean\_resid\_&y)/std\_resid\_&y);

if **.**<z\_resid\_&y<-**1.5** then z\_resid\_&y.\_lt15=**1**;

else if z\_resid\_&y>=-**1.5** then z\_resid\_&y.\_lt15=**0**;

if **.**<z\_resid\_&y<-**1.0** then z\_resid\_&y.\_lt10=**1**;

else if z\_resid\_&y>=-**1.0** then z\_resid\_&y.\_lt10=**0**;

if **.**<z\_resid\_&y<-**2.0** then z\_resid\_&y.\_lt20=**1**;

else if z\_resid\_&y>=-**2.0** then z\_resid\_&y.\_lt20=**0**;

run;

|  |
| --- |
| Variables mentioned in the program code   * Use either WRAT or educg. The former is a surrogate covariate for education. * lmd – Logical Memory Delayed * lmr – Logical Memory Recognition * ltra – Log-transformed Trails A * ltrab – Log-transformed Trails B * lbnt30 - Log-transformed Boston Naming Test (30 items) * Sim - WAIS Similarities * lhvot – Log-transformed Hooper Visual Organization Test * vrd – Visual Reproduction Delayed * vrr – Visual Reproduction Recognition * ltrb\_tra – Not sure, not mentioned in paper or use in final classification code. |

**Petersen-Winblad criteria**

/\*1. Cognitive measure impairment\*/

/\*age/education group cutoffs\*/

pw\_lmd\_i=z\_resid\_lmd\_lt15;

pw\_lmr\_i=z\_resid\_lmr\_lt15;

pw\_ltra\_i=z\_resid\_ltra\_lt15;

pw\_ltrb\_i=z\_resid\_ltrb\_lt15;

pw\_ltrb\_tra\_i=z\_resid\_ltrb\_tra\_lt15;

pw\_lbnt30\_i=z\_resid\_lbnt30\_lt15;

pw\_sim\_i=z\_resid\_sim\_lt15;

pw\_lhvot\_i=z\_resid\_lhvot\_lt15;

pw\_vrd\_i=z\_resid\_vrd\_lt15;

pw\_vrr\_i=z\_resid\_vrr\_lt15;

pw\_sum\_mem\_i=sum(z\_resid\_lmd\_lt15, z\_resid\_lmr\_lt15, z\_resid\_vrd\_lt15,z\_resid\_vrr\_lt15);

/\*age/wrat group cutoffs\*/

pw\_lmdw\_i=z\_residw\_lmd\_lt15;

pw\_lmrw\_i=z\_residw\_lmr\_lt15;

pw\_ltraw\_i=z\_residw\_ltra\_lt15;

pw\_ltrbw\_i=z\_residw\_ltrb\_lt15;

pw\_ltrb\_traw\_i=z\_residw\_ltrb\_tra\_lt15;

pw\_lbnt30w\_i=z\_residw\_lbnt30\_lt15;

pw\_simw\_i=z\_residw\_sim\_lt15;

pw\_lhvotw\_i=z\_residw\_lhvot\_lt15;

pw\_vrdw\_i=z\_residw\_vrd\_lt15;

pw\_vrrw\_i=z\_residw\_vrr\_lt15;

pw\_sum\_memw\_i=sum(z\_residw\_lmd\_lt15, z\_residw\_lmr\_lt15, z\_residw\_vrd\_lt15,z\_residw\_vrr\_lt15);

/\* 2. Domain impairment\*/

/\*age/education group cutoffs\*/

if pw\_sum\_mem\_i>=**1** then pw\_mem\_i=**1**; /\*Visual/verbal memory\*/

if pw\_sum\_mem\_i =**0** then pw\_mem\_i=**0**;

if pw\_ltra\_i=**1** or pw\_ltrb\_i=**1** then pw\_execf\_i=**1**; /\*Executive function/attention\*/

if pw\_ltra\_i=**0** and pw\_ltrb\_i=**0** then pw\_execf\_i=**0**;

if pw\_lbnt30\_i=**1** or pw\_sim\_i=**1** then pw\_lang\_i=**1**; /\*Language\*/

if pw\_lbnt30\_i=**0** and pw\_sim\_i=**0** then pw\_lang\_i=**0**;

/\*age/wrat group cutoffs\*/

if pw\_sum\_memw\_i>=**1** then pw\_memw\_i=**1**; /\*Visual/verbal memory\*/

if pw\_sum\_memw\_i =**0** then pw\_memw\_i=**0**;

if pw\_ltraw\_i=**1** or pw\_ltrbw\_i=**1** then pw\_execfw\_i=**1**; /\*Executive function/attention\*/

if pw\_ltraw\_i=**0** and pw\_ltrbw\_i=**0** then pw\_execfw\_i=**0**;

if pw\_lbnt30w\_i=**1** or pw\_simw\_i=**1** then pw\_langw\_i=**1**; /\*Language\*/

if pw\_lbnt30w\_i=**0** and pw\_simw\_i=**0** then pw\_langw\_i=**0**;

/\*3. overall MCI\*/

if pw\_lmd\_i=**1** or pw\_lmr\_i=**1** or pw\_vrd\_i=**1** or pw\_vrr\_i=**1** or pw\_ltra\_i=**1** or pw\_ltrb\_i=**1** or pw\_lbnt30\_i=**1** or pw\_sim\_i=**1** then pw\_mci=**1**;

else pw\_mci=**0**;

if pw\_lmdw\_i=**1** or pw\_lmrw\_i=**1** or pw\_vrdw\_i=**1** or pw\_vrrw\_i=**1** or pw\_ltraw\_i=**1** or pw\_ltrbw\_i=**1** or pw\_lbnt30w\_i=**1** or pw\_simw\_i=**1** then pw\_mciw=**1**;

else pw\_mciw=**0**;

/\*4. single domain amnestic\*/

if pw\_mem\_i=**1** and pw\_execf\_i=**0** and pw\_lang\_i=**0** then pw\_mci\_sdam=**1**;

else pw\_mci\_sdam=**0**;

if pw\_memw\_i=**1** and pw\_execfw\_i=**0** and pw\_langw\_i=**0** then pw\_mciw\_sdam=**1**;

else pw\_mciw\_sdam=**0**;

/\*5. multi-domain amnestic\*/

if pw\_mem\_i=**1** and (pw\_execf\_i=**1** or pw\_lang\_i=**1**) then pw\_mci\_mdam=**1**;

else pw\_mci\_mdam=**0**;

if pw\_memw\_i=**1** and (pw\_execfw\_i=**1** or pw\_langw\_i=**1**) then pw\_mciw\_mdam=**1**;

else pw\_mciw\_mdam=**0**;

/\*6. single domain non-amnestic\*/

pw\_dsum=sum(of pw\_execf\_i pw\_lang\_i);

pw\_dsumw=sum(of pw\_execfw\_i pw\_langw\_i);

if pw\_mem\_i=**0** and pw\_dsum=**1** then pw\_mci\_sdnam=**1**;

else pw\_mci\_sdnam=**0**;

if pw\_memw\_i=**0** and pw\_dsumw=**1** then pw\_mciw\_sdnam=**1**;

else pw\_mciw\_sdnam=**0**;

/\*6. multi domain non-amnestic\*/

if pw\_mem\_i=**0** and pw\_dsum>**1** then pw\_mci\_mdnam=**1**;

else pw\_mci\_mdnam=**0**;

if pw\_memw\_i=**0** and pw\_dsumw>**1** then pw\_mciw\_mdnam=**1**;

else pw\_mciw\_mdnam=**0**;

**Mark-Bondi criteria**

/\*1. Cognitive measure impairment\*/

/\*age/education group cutoffs\*/

jak\_lmd\_i=z\_resid\_lmd\_lt10;

jak\_lmr\_i=z\_resid\_lmr\_lt10;

jak\_ltra\_i=z\_resid\_ltra\_lt10;

jak\_ltrb\_i=z\_resid\_ltrb\_lt10;

jak\_ltrb\_tra\_i=z\_resid\_ltrb\_tra\_lt10;

jak\_lbnt30\_i=z\_resid\_lbnt30\_lt10;

jak\_sim\_i=z\_resid\_sim\_lt10;

jak\_lhvot\_i=z\_resid\_lhvot\_lt10;

jak\_vrd\_i=z\_resid\_vrd\_lt10;

jak\_vrr\_i=z\_resid\_vrr\_lt10;

jak\_sum\_mem\_i=sum(z\_resid\_lmd\_lt10, z\_resid\_lmr\_lt10, z\_resid\_vrd\_lt10,z\_resid\_vrr\_lt10);

/\*age/wrat group cutoffs\*/

jak\_lmdw\_i=z\_residw\_lmd\_lt10;

jak\_lmrw\_i=z\_residw\_lmr\_lt10;

jak\_ltraw\_i=z\_residw\_ltra\_lt10;

jak\_ltrbw\_i=z\_residw\_ltrb\_lt10;

jak\_ltrb\_traw\_i=z\_residw\_ltrb\_tra\_lt10;

jak\_lbnt30w\_i=z\_residw\_lbnt30\_lt10;

jak\_simw\_i=z\_residw\_sim\_lt10;

jak\_lhvotw\_i=z\_residw\_lhvot\_lt10;

jak\_vrdw\_i=z\_residw\_vrd\_lt10;

jak\_vrrw\_i=z\_residw\_vrr\_lt10;

jak\_sum\_memw\_i=sum(z\_residw\_lmd\_lt10, z\_residw\_lmr\_lt10, z\_residw\_vrd\_lt10,z\_residw\_vrr\_lt10);

/\* 2. Domain impairment\*/

/\*age/education group cutoffs\*/

/\*Visual/verbal memory\*/

if jak\_sum\_mem\_i>=**2** then jak\_mem\_i=**1**;

if jak\_sum\_mem\_i in (**0**,**1**) then jak\_mem\_i=**0**;

/\*Executive function/attention\*/

if jak\_ltra\_i=**1** and jak\_ltrb\_i=**1** then jak\_execf\_i=**1**;

else jak\_execf\_i=**0**;

/\*Language\*/

if jak\_lbnt30\_i=**1** and jak\_sim\_i=**1** then jak\_lang\_i=**1**;

else jak\_lang\_i=**0**;

/\*3. Overall mci\*/

if jak\_mem\_i=**1** or jak\_execf\_i=**1** or jak\_lang\_i=**1** then jak\_mci=**1**;

else jak\_mci=**0**;

if jak\_memw\_i=**1** or jak\_execfw\_i=**1** or jak\_langw\_i=**1** then jak\_mciw=**1**;

else jak\_mciw=**0**;

/\*4. single domain amnestic\*/

if jak\_mem\_i=**1** and jak\_execf\_i=**0** and jak\_lang\_i=**0** then jak\_mci\_sdam=**1**;

else jak\_mci\_sdam=**0**;

if jak\_memw\_i=**1** and jak\_execfw\_i=**0** and jak\_langw\_i=**0** then jak\_mciw\_sdam=**1**;

else jak\_mciw\_sdam=**0**;

/\*5. multi-domain amnestic\*/

if jak\_mem\_i=**1** and (jak\_execf\_i=**1** or jak\_lang\_i=**1**) then jak\_mci\_mdam=**1**;

else jak\_mci\_mdam=**0**;

if jak\_memw\_i=**1** and (jak\_execfw\_i=**1** or jak\_langw\_i=**1**) then jak\_mciw\_mdam=**1**;

else jak\_mciw\_mdam=**0**;

/\*6. single domain non-amnestic\*/

jak\_dsum=sum(of jak\_execf\_i jak\_lang\_i);

jak\_dsumw=sum(of jak\_execfw\_i jak\_langw\_i);

if jak\_mem\_i=**0** and jak\_dsum=**1** then jak\_mci\_sdnam=**1**;

else jak\_mci\_sdnam=**0**;

if jak\_memw\_i=**0** and jak\_dsumw=**1** then jak\_mciw\_sdnam=**1**;

else jak\_mciw\_sdnam=**0**;

/\*6. multi domain non-amnestic\*/

if jak\_mem\_i=**0** and jak\_dsum>**1** then jak\_mci\_mdnam=**1**;

else jak\_mci\_mdnam=**0**;

if jak\_memw\_i=**0** and jak\_dsumw>**1** then jak\_mciw\_mdnam=**1**;

else jak\_mciw\_mdnam=**0**;

**run**;