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```
Libname UKB "E:\Program Files\UKBnew";
options fmtsearch=(UKB);
```

```
Data UKB.hearing_2023_1;
set UKB.ukb_2023;
```

```
keep
```

```
n_eid
```

```
n_21022_0_0
```

```
n_34_0_0
```

```
s_53_0_0
```

```
n_31_0_0
```

```
/****race *****/
```

```
n_21000_0_0
```

```
/****education*****/
```

```
n_6138_0_0 n_6138_1_0 n_6138_2_0
```

```
n_845_0_0 n_845_1_0 n_845_2_0
```

```
/*** Income*****/
```

```
n_738_0_0 n_738_1_0 n_738_2_0 n_738_3_0
```

```
n_26411_0_0
```

```
n_26428_0_0
```

```
n_26418_0_0
```

```
/*Townsend deprivation index at recruitment*/
```

```
n_189_0_0
```

```
/***BMI**/
```

```
n_21001_0_0 n_21001_1_0 n_21001_2_0 n_21001_3_0
```

```
/***waist circumference**/
```

```
n_48_0_0 n_48_1_0 n_48_2_0 n_48_3_0
```

```
/***hip circumference**/
```

```
n_49_0_0 n_49_1_0 n_49_2_0 n_49_3_0
```

```
/***Standing height**/
```

```
n_50_0_0 n_50_1_0 n_50_2_0 n_50_3_0
```

```
/***Weigh**/
```

```
n_21002_0_0 n_21002_1_0 n_21002_2_0 n_21002_3_0
```

```
/***Smoking status**/
```

```
n_20116_0_0 n_20116_1_0 n_20116_2_0 n_20116_3_0
```

/Alcohol status**/**

n_1558_0_0 n_1558_1_0 n_1558_2_0 n_1558_3_0

/physical activity****/**

n_22032_0_0

n_104910_0_0 n_104910_1_0 n_104910_2_0 n_104910_3_0 n_104910_4_0

n_884_0_0 n_884_1_0 n_884_2_0 n_884_3_0

/Apoe status **/**

s_affy16020316 **/*rs429358*/**

s_affy16020324 **/*rs7412*/**

/Diabetes diagnosed by doctor**/**

n_2443_0_0 n_2443_1_0 n_2443_2_0 n_2443_3_0

/Medication for cholesterol, blood pressure, diabetes, or take exogenous hormones. **/**

n_6153_0_0 n_6153_0_1 n_6153_0_2 n_6153_0_3

n_6153_1_0 n_6153_1_1 n_6153_1_2 n_6153_1_3

n_6153_2_0 n_6153_2_1 n_6153_2_2 n_6153_2_3

/Vascular/heart problems diagnosed by doctor**/**

n_6150_0_0 n_6150_0_1 n_6150_0_2 n_6150_0_3

n_6150_1_0 n_6150_1_1 n_6150_1_2 n_6150_1_3

n_6150_2_0 n_6150_2_1 n_6150_2_2 n_6150_2_3

/Age heart attack diagnosed**/**

/*n_3894_0_0 n_3894_1_0 n_3894_2_0 n_3894_3_0

/Age angina diagnosed**/**

n_3627_0_0 n_3627_1_0 n_3627_2_0

/Age stroke diagnosed**/**

n_4056_0_0 n_4056_1_0 n_4056_2_0

/Age high blood pressure diagnosed**/**

n_2966_0_0 n_2966_1_0 n_2966_2_0

/*Date G31 first reported (other degenerative diseases of nervous system, not elsewhere classified)*/

s_131038_0_0

/*Date G30 first reported (alzheimers disease)*/

s_131036_0_0

/*Glycated haemoglobin (HbA1c)*/

n_30750_0_0 n_30750_1_0

/*DEPRESSION*/

n_2050_0_0 n_2050_1_0 n_2050_2_0 n_2050_3_0

/*loneliness*/

n_2020_0_0 n_2020_1_0 n_2020_2_0 n_2020_3_0

/* Number in household*/

n_709_0_0 n_709_1_0 n_709_2_0 n_709_3_0

/*Frequency of friend/family visits*/

n_1031_0_0 n_1031_1_0 n_1031_2_0 n_1031_3_0

/**Weight loss**/

n_2306_0_0 n_2306_1_0 n_2306_2_0 n_2306_3_0

/*Illnesses of father*/

n_20107_0_0 n_20107_1_0 n_20107_2_0 n_20107_3_0

n_20107_0_1 n_20107_1_1 n_20107_2_1 n_20107_3_1

n_20107_0_2 n_20107_1_2 n_20107_2_2 n_20107_3_2

n_20107_0_3 n_20107_1_3 n_20107_2_3 n_20107_3_3

n_20107_0_4 n_20107_1_4 n_20107_2_4 n_20107_3_4

n_20107_0_5 n_20107_1_5 n_20107_2_5 n_20107_3_5

n_20107_0_6 n_20107_1_6 n_20107_2_6

n_20107_0_7 n_20107_1_7 n_20107_2_7

n_20107_0_8

n_20107_0_9

/*Illnesses of mother*/

n_20110_0_0 n_20110_1_0 n_20110_2_0 n_20110_3_0

n_20110_0_1 n_20110_1_1 n_20110_2_1 n_20110_3_1

n_20110_0_2 n_20110_1_2 n_20110_2_2 n_20110_3_2

n_20110_0_3 n_20110_1_3 n_20110_2_3 n_20110_3_3

n_20110_0_4 n_20110_1_4 n_20110_2_4 n_20110_3_4

n_20110_0_5 n_20110_1_5 n_20110_2_5

n_20110_0_6 n_20110_1_6 n_20110_2_6

n_20110_0_7

n_20110_0_8

n_20110_0_9

n_20110_0_10

/* Illnesses of siblings*/

n_20111_0_0-n_20111_0_11

/****** Hearing *****/

/*Self-reported: Hearing difficulty problems*/

n_2247_0_0 n_2247_1_0 n_2247_2_0 n_2247_3_0

*/*Self-reported: Hearing aid user*/*

n_3393_0_0 n_3393_1_0 n_3393_2_0 n_3393_3_0

*/*Self-reported: Cochlear implant*/*

n_4792_0_0 n_4792_1_0 n_4792_2_0 n_4792_3_0

*/*Speech-reception-threshold (SRT) estimate (left)*/*

n_20019_0_0 n_20019_1_0 n_20019_2_0 n_20019_3_0

*/*Speech-reception-threshold (SRT) estimate (right)*/*

n_20021_0_0 n_20021_1_0 n_20021_2_0 n_20021_3_0

*/*Main_ICD10*/*

s_41202_0_0-s_41202_0_78

*/**Date of first in-patient diagnosis - main ICD10**/*

s_41262_0_0-s_41262_0_78

*/*Sec_ICD10 */*

s_41204_0_0-s_41204_0_187

*/*UKB_ICD10*/*

s_41270_0_0-s_41270_0_242

*/**Date of first in-patient diagnosis - ICD10**/*

s_41280_0_0-s_41280_0_242

s_40000_0_0 */**Date of death**/*

s_42018_0_0 */*Date of all cause dementia report**/*

s_42020_0_0 */** Date of alzheimer's disease report**/*

s_42022_0_0 */* Date of vascular dementia report**/*

;

run;

```
Data UKB.hearing_2023_2;
set UKB.hearing_2023_1;
```

```
/******Definition:Covariates******/
```

```
T1age=n_21022_0_0;
birthyear=n_34_0_0;
T1year=year(s_53_0_0);
```

```
/******age******/
```

```
if T1age<50 then T1age_c =1;
else if T1age>=50 and T1age<=60 then T1age_c=2;
else if T1age>60 then T1age_c=3;
```

```
/******race******/
```

```
if n_21000_0_0 in (1,1001,1002,1003) then race=1;/*white*/
else if n_21000_0_0 in (2,2001,2002,2003,2004) then race=2;/*mixed*/
else if n_21000_0_0 in (3,3001,3002,3003,3004) then race=3;/*Asian background*/
else if n_21000_0_0 in (4,4001,4002,4003) then race=4;/*black background*/
else if n_21000_0_0=5 then race=5;/*Chinese*/
else if n_21000_0_0=6 then race=6;/*Other ethnic group*/
if race=. then race=6;
```

```
if race=1 then race_X=1;
else if race in (3,5) then race_X=2;
else if race in (2,6) then race_X=4;
else if race=4 then race_X=3;
```

```
/******education******/
```

```
/*n_6138_0_0, n_6138_1_0, n_6138_2_0: Qualifications
```

- 1: College or University degree
- 2: A levels/AS levels or equivalent (higher school certificate - most students complete at age 18)
- 3: O levels/GCSEs or equivalent (most students complete O level at age 16)
- 4: CSEs or equivalent (most students complete CSE at age 16)
- 5: NVQ or HND or HNC or equivalent (most students completed at age 15)
- 6: Other professional qualifications eg: nursing, teaching

- 7: None of the above qualification
- 3: Prefer not to answer*/

/*n_845_0_0, n_845_1_0, n_845_2_0 :Age completed full time education - use this variable if data on qualification were missing
 /*n_845_0_0 was not collected from participants who indicated they have a college or university degree

- 2: never went to school*/

```
if n_6138_0_0 eq 1 then education=5;
else if n_6138_0_0 eq 2 then education=3;
else if n_6138_0_0 in (3,4,5) then education=2;
else if n_6138_0_0 eq 6 then education=4;
else if -1<=(n_845_0_0-6)<=10 then education=2;/*"Compulsory school age begins following a
child's fifth birthday in UK (age 5/6); most students complete O level/CSE at age 16*/
else if 10<(n_845_0_0-6)<=12 then education=3;/*most students complete A level at age 18*/
else if (n_845_0_0-6)>12 then education=4;/*women who have a college or university degree did
not report n_845_0_0*/
else if n_6138_0_0 eq -7 or n_845_0_0 eq -2 then education=1;/*-7:None of the above
qualification; -2:never went to school*/
```

/*among women with missing data on education, use n_6138_1_0 and n_845_1_0 (first repeated assessment) to define baseline education level;
 to confirm that college/university degree and professional qualifications completed before baseline, n_845_1_0 must be younger than T1age*/

```
if education=. and (n_845_1_0<T1age) then do;
if n_6138_1_0 eq 1 then education=5;
else if n_6138_1_0 eq 2 then education=3;
else if n_6138_1_0 in (3,4,5) then education=2;
else if n_6138_1_0 eq 6 then education=4;
else if -1<=(n_845_1_0-6)<=10 then education=2;
else if 10<(n_845_1_0-6)<=12 then education=3;
else if (n_845_1_0-6)>12 then education=4;
else if n_6138_1_0 eq -7 or n_845_1_0 eq -2 then education=1;
end;
```

```
if education=. and (n_845_2_0<T1age) then do;
```

```

if n_6138_2_0 eq 1 then education=5;
else if n_6138_2_0 eq 2 then education=3;
else if n_6138_2_0 in (3,4,5) then education=2;
else if n_6138_2_0 eq 6 then education=4;
else if -1<=(n_845_2_0-6)<=10 then education=2;
else if 10<(n_845_2_0-6)<=12 then education=3;
else if (n_845_2_0-6)>12 then education=4;
else if n_6138_2_0 eq -7 or n_845_2_0 eq -2 then education=1;
end;

```

```

/*education categories for reference

```

- 1) no formal
- 2) year 10
- 3) year 12
- 4) trade/diploma/vocational
- 5) college/univeristy*/

```

if education in (1,2) then education1=1; /**<=10**/
else if education=3 then education1=2; /**11-12**/
else if education in (4,5) then education1=3;/**>12*/

```

```

/***** Income ** */

```

```

/*income***/ n_738_0_0 n_738_1_0 n_738_2_0 n_738_3_0:

```

- 1 Less than £ 18,000
- 2 18,000 to 30,999
- 3 31,000 to 51,999
- 4 52,000 to 100,000
- 5 Greater than 100,000
- 1 Do not know
- 3 Prefer not to answer*/

```

if max(n_738_0_0, n_738_1_0, n_738_2_0, n_738_3_0)=1 then income=1;
else if max(n_738_0_0, n_738_1_0, n_738_2_0, n_738_3_0)=2 then income=2;
else if max(n_738_0_0, n_738_1_0, n_738_2_0, n_738_3_0)=3 then income=3;
else if max(n_738_0_0, n_738_1_0, n_738_2_0, n_738_3_0)>=4 then income=4;

```

```

/*

```


To deal with the missing of income, use the following variable to define

n_26411_0_0 Income score (England)

n_26428_0_0 Income score (Scotland)

n_26418_0_0 Income score (Wales)

*/

If income=. then do;

if n_26411_0_0>0 and n_26411_0_0<=0.05 then income=1;

else if 0.05<n_26411_0_0<=0.08 then income=2;

else if 0.08<n_26411_0_0<=0.15 then income=3;

else if n_26411_0_0>0.15 then income=4;

if n_26428_0_0>0 and n_26428_0_0<=4 then income=1;

else if 4<n_26428_0_0<=7 then income=2;

else if 7<n_26428_0_0<=15 then income=3;

else if n_26428_0_0>15 then income=4;

if n_26418_0_0>0 and n_26418_0_0<=1.8 then income=1;

else if 1.8<n_26418_0_0<=6 then income=2;

else if 6<n_26418_0_0<=18.5 then income=3;

else if n_26418_0_0>18.5 then income=4;

end;

/******Townsend *****/

if n_189_0_0<-3.65 and n_189_0_0>-6.26 then TS =1;

else if n_189_0_0<-2.16 and n_189_0_0>-3.64 then TS =2;

else if n_189_0_0<0.50 and n_189_0_0>-2.16 then TS =3;

else if n_189_0_0<11.1 and n_189_0_0>0.50 then TS =4;

/******family history of AD/Dementia *****/

/* Illnesses of father

10: Alzheimer's disease/dementia

-11: Do not know (group 1)

-13: Prefer not to answer (group 1)

-17: None of the above (group 1)

-21: Do not know (group 2)

- 23: Prefer not to answer (group 2)
- 27: None of the above (group 2)*/

/**AD**/

if n_20107_0_0>. then do;

if n_20107_0_0=10 or n_20107_0_1=10 or n_20107_0_2=10 or n_20107_0_3=10 or
n_20107_0_4=10 or n_20107_0_5=10 or n_20107_0_6=10 or n_20107_0_7=10 or
n_20107_0_8=10 or n_20107_0_9=10 then T1ADfather=1;

else T1ADfather=0;

end;

/*overwrite and set to missing if fit the following conditions */

if n_20107_0_0 eq -13 then T1ADfather=.;

else if n_20107_0_0 eq -11 and n_20107_0_1 in(-21,-23) then T1ADfather=.;

if n_20107_1_0>. then do;

if n_20107_1_0=10 or n_20107_1_1=10 or n_20107_1_2=10 or n_20107_1_3=10 or
n_20107_1_4=10 or n_20107_1_5=10 or n_20107_1_6=10 or n_20107_1_7=10 or
T1ADfather=1 then T2ADfather=1;

else T2ADfather=0;

end;

if n_20107_1_0 eq -13 then T2ADfather=.;

else if n_20107_1_0 eq -11 and n_20107_1_1 in(-21,-23) then T2ADfather=.;

if n_20107_2_0>. then do;

if n_20107_2_0=10 or n_20107_2_1=10 or n_20107_2_2=10 or n_20107_2_3=10 or
n_20107_2_4=10 or n_20107_2_5=10 or n_20107_2_6=10 or n_20107_2_7=10 or T2ADfather=1
or T1ADfather=1 then T3ADfather=1;

else T3ADfather=0;

end;

if n_20107_2_0 eq -13 then T3ADfather=.;

else if n_20107_2_0 eq -11 and n_20107_2_1 in(-21,-23) then T3ADfather=.;

if n_20107_3_0>. then do;

if n_20107_3_0=10 or n_20107_3_1=10 or n_20107_3_2=10 or n_20107_3_3=10 or
n_20107_3_4=10 or n_20107_3_5=10 or T3ADfather=1 or T2ADfather=1 or T1ADfather=1 then
T4ADfather=1;

else T4ADfather=0;

```

end;
if n_20107_3_0 eq -13 then T4ADfather=.;
else if n_20107_3_0 eq -11 and n_20107_3_1 in(-21,-23) then T4ADfather=.;

ADfather=max(T1ADfather, T2ADfather, T3ADfather, T4ADfather);

/* Illnesses of mother**/

if n_20110_0_0>. then do;
if n_20110_0_0=10 or n_20110_0_1=10 or n_20110_0_2=10 or n_20110_0_3=10 or
n_20110_0_4=10 or n_20110_0_5=10 or n_20110_0_6=10 or n_20110_0_7=10 or
n_20110_0_8=10 or n_20110_0_9=10 or n_20110_0_10=10 then T1ADmother=1;
else T1ADmother=0;
end;
if n_20110_0_0 eq -13 then T1ADmother=.;
else if n_20110_0_0 eq -11 and n_20110_0_1 in(-21,-23) then T1ADmother=.;

if n_20110_1_0>. then do;
if n_20110_1_0=10 or n_20110_1_1=10 or n_20110_1_2=10 or n_20110_1_3=10 or
n_20110_1_4=10 or n_20110_1_5=10 or n_20110_1_6=10 or T1ADmother=1 then
T2ADmother=1;
else T2ADmother=0;
end;
if n_20110_1_0 eq -13 then T2ADmother=.;
else if n_20110_1_0 eq -11 and n_20110_1_1 in(-21,-23) then T2ADmother=.;

if n_20110_2_0>. then do;
if n_20110_2_0=10 or n_20110_2_1=10 or n_20110_2_2=10 or n_20110_2_3=10 or
n_20110_2_4=10 or n_20110_2_5=10 or n_20110_2_6=10 or T2ADmother=1 or T1ADmother=1
then T3ADmother=1;
else T3ADmother=0;
end;
if n_20110_2_0 eq -13 then T3ADmother=.;
else if n_20110_2_0 eq -11 and n_20110_2_1 in(-21,-23) then T3ADmother=.;

if n_20110_3_0>. then do;
if n_20110_3_0=10 or n_20110_3_1=10 or n_20110_3_2=10 or n_20110_3_3=10 or

```

```

n_20110_3_4=10 or T3ADmother=1 or T2ADmother=1 or T1ADmother=1 then T4ADmother=1;
else T4ADmother=0;
end;
if n_20110_3_0 eq -13 then T4ADmother=.;
else if n_20110_3_0 eq -11 and n_20110_3_1 in(-21,-23) then T4ADmother=.;

ADmother=max(T1ADmother, T2ADmother, T3ADmother, T4ADmother);

```

```

/* Illnesses of siblings*/

```

```

if n_20111_0_0>. then do;
if n_20111_0_0=10 or n_20111_0_1=10 or n_20111_0_2=10 or n_20111_0_3=10 or
n_20111_0_4=10 or n_20111_0_5=10 or n_20111_0_6=10 or n_20111_0_7=10 or
n_20111_0_8=10 or n_20111_0_9=10 or n_20111_0_10=10 or n_20111_0_11=10 then
T1ADsiblings=1;
else T1ADsiblings=0;
end;
if n_20111_0_0 eq -13 then T1ADsiblings=.;
else if n_20111_0_0 eq -11 and n_20111_0_1 in(-21,-23) then T1ADsiblings=.;

```

```

Dementia_family_history=max(ADfather,ADmother, T1ADsiblings);

```

```

/*****height, weight, waist, BMI*****/

```

```

/*Height*/

```

```

T1height=n_50_0_0;
T2height=n_50_1_0;
T3height=n_50_2_0;
T4height=n_50_3_0;

```

```

/*Weight*/

```

```

T1weight=n_21002_0_0;
T2weight=n_21002_1_0;
T3weight=n_21002_2_0;
T4weight=n_21002_3_0;

```

```

/*BMI*/

```

```

T1bmi=n_21001_0_0;

```

```
T2bmi=n_21001_1_0;  
T3bmi=n_21001_2_0;  
T4bmi=n_21001_3_0;
```

```
/*waist*/
```

```
T1waist=n_48_0_0;  
T2waist=n_48_1_0;  
T3waist=n_48_2_0;  
T4waist=n_48_3_0;
```

```
/*Hip*/
```

```
T1hip=n_49_0_0;  
T2hip=n_49_1_0;  
T3hip=n_49_2_0;  
T4hip=n_49_3_0;
```

```
if T1bmi>0 then bmi_B=T1bmi;  
else if T1bmi=. and T2bmi>0 then bmi_B=T2bmi;  
else if T1bmi=. and T2bmi=. and T3bmi>0 then bmi_B=T3bmi;  
else if T1bmi=. and T2bmi=. and T3bmi=. and T4bmi>0 then bmi_B=T4bmi;
```

```
/*in 4 categories group*/
```

```
if bmi_B >0 and bmi_B <18.5 then bmi4group_b=1;  
else if bmi_B >=18.5 and bmi_B < 25 then bmi4group_b=2;  
else if bmi_B >=25 and bmi_B < 30 then bmi4group_b=3;  
else if bmi_B >=30 then bmi4group_b=4;
```

```
/******smoking******/
```

```
/*n_20116_0_0, n_20116_1_0, n_20116_2_0, n_20116_3_0: Smoking status
```

```
0: Never
```

```
1: Previous
```

```
2: Current
```

```
-3: Prefer not to answer*/
```

```
array smoking[4] n_20116_0_0 n_20116_1_0 n_20116_2_0 n_20116_3_0;
```

```
array Tsmoking[4] T1smoking T2smoking T3smoking T4smoking;
```

```

do i= 1 to 4;
Tsmoking[i]=smoking[i];
if smoking[i]=-3 then Tsmoking[i]= .;
end;

if T1smoking ne . then smoking_B=T1smoking;
else if T1smoking=. and T2smoking ne . then smoking_B=T2smoking;
else if T1smoking=. and T2smoking=. and T3smoking ne . then smoking_B=T3smoking;
else if T1smoking=. and T2smoking=. and T3smoking=. and T4smoking ne . then
smoking_B=T4smoking;

/*****acohol *****/
array AC_1[4] n_1558_0_0 n_1558_1_0 n_1558_2_0 n_1558_3_0;
array AC_2[4] T1AC T2AC T3AC T4AC;

do i= 1 to 4;
AC_2[i]=AC_1[i];
if AC_2[i] in (-3) then AC_2[i]= .;
end;

if T1AC ne . then AC_B=T1AC;
else if T1AC=. and T2AC ne . then AC_B=T2AC;
else if T1AC=. and T2AC=. and T3AC ne . then AC_B=T3AC;
else if T1AC=. and T2AC=. and T3AC=. and T4AC ne . then AC_B=T4AC;

if AC_B=-3 then delete;
if AC_B=1 then AC_C=1;
else if AC_B=2 then AC_C=2;
else if AC_B=3 then AC_C=3;
else if AC_B in (4,5) then AC_C=4;
else if AC_B=6 then AC_C=5;

/***** Physical activity *****/
/*22032:IPAQ activity group 0:low 1:moderate 2:high*/

if n_22032_0_0=0 then PA_level=0;
else if n_22032_0_0=1 then PA_level=1;

```

```
else if n_22032_0_0=2 then PA_level=2;
```

```
/**
```

```
Use the following to define
```

```
n_104910_0_0 n_104910_1_0 n_104910_2_0 n_104910_3_0 n_104910_4_0  
n_884_0_0 n_884_1_0 n_884_2_0 n_884_3_0
```

```
Data-Field 104910
```

```
Coding Meaning
```

```
0 None
```

```
10 Under 10 minutes
```

```
12 1-2 hours
```

```
24 2-4 hours
```

```
46 4-6 hours
```

```
600 6+ hours
```

```
1030 10-30 minutes
```

```
3060 30-60 minutes
```

```
**/
```

```
if PA_level=. then do;
```

```
if n_104910_0_0 in (0,10) or n_104910_1_0 in (0,10) or n_104910_2_0 in (0,10) or  
n_104910_3_0 in (0,10) or n_104910_4_0 in (0,10) then PA_level=0;
```

```
else if n_104910_0_0 in (1030,3060) or n_104910_1_0 in (1030,3060) or n_104910_2_0 in  
(1030,3060) or n_104910_3_0 in (1030,3060) or n_104910_4_0 in (1030,3060) then  
PA_level=1;
```

```
else if n_104910_0_0 in (12,24,46,600) or n_104910_1_0 in (12,24,46,600) or n_104910_2_0 in  
(12,24,46,600) or n_104910_3_0 in (12,24,46,600) or n_104910_4_0 in (12,24,46,600) then  
PA_level=2;
```

```
end;
```

```
if PA_level=. then do;
```

```
if 0<=n_884_0_0<=2 or 0<=n_884_1_0<=2 or 0<=n_884_2_0<=2 or  
0<=n_884_3_0<=2 then PA_level=0;
```

```

else if 3<=n_884_0_0<=5 or 3<=n_884_1_0<=5 or 3<=n_884_2_0<=5 or
3<=n_884_3_0<=5 then PA_level=1;
else if 6<=n_884_0_0<=7 or 6<=n_884_1_0<=7 or 6<=n_884_2_0<=7 or
6<=n_884_3_0<=7 then PA_level=2;

```

```
end;
```

```

/*****          apoe4 Status          *****/
if s_affy16020316 in ("T T") and s_affy16020324 in ("T T")      then APOE=1;
/*E2_E2*/
else if s_affy16020316 in ("T T") and s_affy16020324 in ("T C") then APOE=2;
/*E2_E3*/
else if s_affy16020316 in ("C T") and s_affy16020324 in ("T C") then APOE=3;
/*E2_E4*/
else if s_affy16020316 in ("T T") and s_affy16020324 in ("C C") then APOE=4;
/*E3_E3*/
else if s_affy16020316 in ("C T") and s_affy16020324 in ("C C") then APOE=5;
/*E3_E4*/
else if s_affy16020316 in ("C C") and s_affy16020324 in ("C C") then APOE=6;
/*E4_E4*/
else if s_affy16020316 in ("0 0") OR s_affy16020324 in ("0 0") then APOE=7;      /*none*/
If      APOE in (1, 2, 4, 7) then APOE_status=0;
else if APOE in (3, 5) then APOE_status=1;
else if APOE in (6) then APOE_status=2;

```

```

/*****diabetes*****/

```

```

/*n_2443_0_0, n_2443_1_0, n_2443_2_0, n_2443_3_0: Diabetes diagnosed by doctor: Has a
doctor ever told you that you have diabetes? (include those who only had diabetes during
pregnancy)

```

```
1: Yes
```

```
0: No
```

```
-1: Do not know
```

```
-3: Prefer not to answer*/

```

```

/*n_6153_0_0, n_6153_0_1, n_6153_0_2, n_6153_0_3

```


n_6153_1_0, n_6153_1_1, n_6153_1_2, n_6153_1_3
n_6153_2_0, n_6153_2_1, n_6153_2_2, n_6153_2_3: Medication for cholesterol, blood pressure,
diabetes, or take exogenous hormones.

Do you regularly take any of the following medications?

3:insulin*/

if n_2443_0_0=1 or (n_6153_0_0=3 or n_6153_0_1=3 or n_6153_0_2=3 or n_6153_0_3=3) then
T1diab=1; /*include those who only had diabetes during pregnancy*/

else if n_2443_0_0=0 then T1diab=0;

/*define those who only had diabetes during pregnancy as non-diabetes*/

/*they should not regularly take insulin either*/

if n_4041_0_0=1 and (n_6153_0_0 ne 3 and n_6153_0_1 ne 3 and n_6153_0_2 ne 3 and
n_6153_0_3 ne 3) then T1diab=0;

if n_2443_1_0>. then do;

if n_2443_1_0=1 or (n_6153_1_0=3 or n_6153_1_1=3 or n_6153_1_2=3 or n_6153_1_3=3) or
T1diab=1 then T2diab=1;

else if n_2443_1_0=0 then T2diab=0;

end;

if n_4041_1_0=1 and (n_6153_1_0 ne 3 and n_6153_1_1 ne 3 and n_6153_1_2 ne 3 and
n_6153_1_3 ne 3) then T2diab=0;

if n_2443_2_0>. then do;

if n_2443_2_0=1 or (n_6153_2_0=3 or n_6153_2_1=3 or n_6153_2_2=3 or n_6153_2_3=3) or
T2diab=1 or T1diab=1 then T3diab=1;

else if n_2443_2_0=0 then T3diab=0;

end;

if n_4041_2_0=1 and (n_6153_2_0 ne 3 and n_6153_2_1 ne 3 and n_6153_2_2 ne 3 and
n_6153_2_3 ne 3) then T3diab=0;

diab_ever=max(T1diab, T2diab, T3diab);

*****Exposure: Self-reported CVD*****

/*n_6150_0_0, n_6150_0_1, n_6150_0_2, n_6150_0_3

n_6150_1_0, n_6150_1_1, n_6150_1_2, n_6150_1_3

n_6150_2_0, n_6150_2_1, n_6150_2_2, n_6150_2_3

Vascular/heart problems

diagnosed by doctor

- 1: Heart attack
- 2: Angina
- 3: Stroke
- 4: High blood pressure
- 7: None of the above
- 3: Prefer not to answer*/

```
/******heart attack******/
```

```
/*the baseline (2006-2010)*/
```

```
if n_6150_0_0=1 or n_6150_0_1=1 or n_6150_0_2=1 or n_6150_0_3=1 then T1heartattack=1;  
else if n_6150_0_0>. and n_6150_0_0 ne -3 then T1heartattack=0;
```

```
/*First repeat assessment (2012-13)*/
```

```
if n_6150_1_0>. then do;
```

```
if n_6150_1_0=1 or n_6150_1_1=1 or n_6150_1_2=1 or n_6150_1_3=1 or T1heartattack=1 then  
T2heartattack=1;
```

```
else if n_6150_1_0>. and n_6150_1_0 ne -3 then T2heartattack=0;
```

```
end;
```

```
/*Second repeat assessment:Imaging visit (2014+)*/
```

```
if n_6150_2_0>. then do;
```

```
if n_6150_2_0=1 or n_6150_2_1=1 or n_6150_2_2=1 or n_6150_2_3=1 or T2heartattack=1 or  
T1heartattack=1 then T3heartattack=1;
```

```
else if n_6150_2_0>. and n_6150_2_0 ne -3 then T3heartattack=0;
```

```
end;
```

```
heartattack_ever=max(T1heartattack, T2heartattack, T3heartattack);
```

```
/*n_3894_0_0, n_3894_1_0, n_3894_2_0, n_3894_3_0: Age heart attack diagnosed (collected  
from participants who were told by a doctor that they have had a heart attack, as defined by  
n_6150)
```

```
-1: Do not know
```

```
-3: Prefer not to answer*/
```

```
if n_3894_0_0>0 and T1heartattack=1 then T1heartattackage=n_3894_0_0;
```

```
if n_3894_1_0>0 and T2heartattack=1 then T2heartattackage=n_3894_1_0;
```

```
if 0<T2heartattackage<T1heartattackage then T2heartattackage=T1heartattackage;
```

```
if n_3894_2_0>0 and T3heartattack=1 then T3heartattackage=n_3894_2_0;
```

```
if 0<T3heartattackage<T2heartattackage then T3heartattackage=T2heartattackage;
```

```
else if 0<T3heartattackage<T1heartattackage then T3heartattackage=T1heartattackage;
```

```
heartattackage=min(T1heartattackage, T2heartattackage, T3heartattackage);
```

```
array Theartattack[3] T1heartattack T2heartattack T3heartattack;
```

```
recn=0; /*preset recn=0*/
```

```
do i=1 to 3;
```

```
if heartattackage=. then do;
```

```
if Theartattack[i]>=0 then recn+1;
```

```
if Theartattack[i]=1 then heartattackage=Tage[i];
```

```
if 0<heartattackage=Tage[i] and recn=1 then imputedhatkage=1;
```

```
else if 0<heartattackage=Tage[i] and recn>1 then imputedhatkage=2;
```

```
end;
```

```
end;
```

```
/******angina******/
```

```
if n_6150_0_0=2 or n_6150_0_1=2 or n_6150_0_2=2 or n_6150_0_3=2 then T1angina=1;
```

```
else if n_6150_0_0>. and n_6150_0_0 ne -3 then T1angina=0;
```

```
if n_6150_1_0>. then do;
```

```
if n_6150_1_0=2 or n_6150_1_1=2 or n_6150_1_2=2 or n_6150_1_3=2 or T1angina=1 then
```

```
T2angina=1;
```

```
else if n_6150_1_0>. and n_6150_1_0 ne -3 then T2angina=0;
```

```
end;
```

```
if n_6150_2_0>. then do;
```

```
if n_6150_2_0=2 or n_6150_2_1=2 or n_6150_2_2=2 or n_6150_2_3=2 or T2angina=1 or
```

```
T1angina=1 then T3angina=1;
```

```
else if n_6150_2_0>. and n_6150_2_0 ne -3 then T3angina=0;
```

```
end;
```

```
angina_ever=max(T1angina, T2angina, T3angina);
```

```
/*n_3627_0_0, n_3627_1_0, n_3627_2_0: Age angina diagnosed (collected from participants who were told by a doctor that they have had an angina, as defined by n_6150)
```

```
-1: Do not know
```

```
-3: Prefer not to answer*/
```

```
if n_3627_0_0>0 and T1angina=1 then T1angage=n_3627_0_0;
```

```
if n_3627_1_0>0 and T2angina=1 then T2angage=n_3627_1_0;
```

```
if 0<T2angage<T1angage then T2angage=T1angage;
```

```
if n_3627_2_0>0 and T3angina=1 then T3angage=n_3627_2_0;
```

```
if 0<T3angage<T2angage then T3angage=T2angage;
```

```
else if 0<T3angage<T1angage then T3angage=T1angage;
```

```
angage=min(T1angage, T2angage, T3angage);
```

```
array Tangina[3] T1angina T2angina T3angina;
```

```
recn=0; /*preset recn=0*/
```

```
do i=1 to 3;
```

```
if angage=. then do;
```

```
if Tangina[i]>=0 then recn+1;
```

```
if Tangina[i]=1 then angage=Tage[i];
```

```
if 0<angage=Tage[i] and recn=1 then imputedangage=1;
```

```
else if 0<angage=Tage[i] and recn>1 then imputedangage=2;
```

```
end;
```

```
end;
```

```
/******Stroke******/
```

```
if n_6150_0_0=3 or n_6150_0_1=3 or n_6150_0_2=3 or n_6150_0_3=3 then T1stroke=1;
```

```
else if n_6150_0_0>. and n_6150_0_0 ne -3 then T1stroke=0;
```

```
if n_6150_1_0>. then do;
```

```
if n_6150_1_0=3 or n_6150_1_1=3 or n_6150_1_2=3 or n_6150_1_3=3 or T1stroke=1 then
```

```
T2stroke=1;
```

```

else if n_6150_1_0>. and n_6150_1_0 ne -3 then T2stroke=0;
end;

if n_6150_2_0>. then do;
if n_6150_2_0=3 or n_6150_2_1=3 or n_6150_2_2=3 or n_6150_2_3=3 or T2stroke=1 or
T1stroke=1 then T3stroke=1;
else if n_6150_2_0>. and n_6150_2_0 ne -3 then T3stroke=0;
end;

Stroke_ever=max(T1stroke, T2stroke, T3stroke);
/*if Stroke_ever=. then Stroke_ever=0;*/

/*n_4056_0_0, n_4056_1_0, n_4056_2_0: Age stroke diagnosed (collected from participants who
were told by a doctor that they have had a stroke, as defined by n_6150)
-1: Do not know
-3: Prefer not to answer*/

if n_4056_0_0>0 and T1stroke=1 then T1strokeage=n_4056_0_0;

if n_4056_1_0>0 and T2stroke=1 then T2strokeage=n_4056_1_0;
if 0<T2strokeage<T1strokeage then T2strokeage=T1strokeage;

if n_4056_2_0>0 and T3stroke=1 then T3strokeage=n_4056_2_0;
if 0<T3strokeage<T2strokeage then T3strokeage=T2strokeage;
else if 0<T3strokeage<T1strokeage then T3strokeage=T1strokeage;

strokeage=min(T1strokeage, T2strokeage, T3strokeage);

array Tstroke[3] T1stroke T2stroke T3stroke;

recn=0; /*preset recn=0*/
do i=1 to 3;
if strokeage=. then do;
if Tstroke[i]>=0 then recn+1;
if Tstroke[i]=1 then strokeage=Tage[i];
if 0<strokeage=Tage[i] and recn=1 then imputedstrokeage=1;
else if 0<strokeage=Tage[i] and recn>1 then imputedstrokeage=2;

```

```

end;
end;
/*****hypertension *****/
/*n_6153_0_0, n_6153_0_1, n_6153_0_2, n_6153_0_3
n_6153_1_0, n_6153_1_1, n_6153_1_2, n_6153_1_3
n_6153_2_0, n_6153_2_1, n_6153_2_2, n_6153_2_3: Medication for cholesterol, blood pressure,
diabetes, or take exogenous hormones.
Do you regularly take any of the following medications?
    2: Blood pressure medication*/

if n_6150_0_0=4 or n_6150_0_1=4 or n_6150_0_2=4 or n_6150_0_3=4 or (n_6153_0_0=2 or
n_6153_0_1=2 or n_6153_0_2=2 or n_6153_0_3=2) then T1hypertension=1;
else if n_6150_0_0>. and n_6150_0_0 ne -3 then T1hypertension=0;

if n_6150_1_0>. then do;
if n_6150_1_0=4 or n_6150_1_1=4 or n_6150_1_2=4 or n_6150_1_3=4 or (n_6153_1_0=2 or
n_6153_1_1=2 or n_6153_1_2=2 or n_6153_1_3=2) or T1hypertension=1 then T2hypertension=1;
else if n_6150_1_0>. and n_6150_1_0 ne -3 then T2hypertension=0;
end;

if n_6150_2_0>. then do;
if n_6150_2_0=4 or n_6150_2_1=4 or n_6150_2_2=4 or n_6150_2_3=4 or (n_6153_2_0=2 or
n_6153_2_1=2 or n_6153_2_2=2 or n_6153_2_3=2) or T2hypertension=1 or T1hypertension=1
then T3hypertension=1;
else if n_6150_2_0>. and n_6150_2_0 ne -3 then T3hypertension=0;
end;

hypertension_ever=max(T1hypertension, T2hypertension, T3hypertension);

/*n_2966_0_0, n_2966_1_0, n_2966_2_0: Age high blood pressure diagnosed (collected from
participants who were told by a doctor that they have had a hypertension, as defined by n_6150)*/

if n_2966_0_0>0 and T1hypertension=1 then T1HPage=n_2966_0_0;

if n_2966_1_0>0 and T1hypertension=1 then T2HPage=n_2966_1_0;
if 0<T2HPage<T1HPage then T2HPage=T1HPage;

```

```

if n_2966_2_0>0 and T1hypertension=1 then T3HPage=n_2966_2_0;
if 0<T3HPage<T2HPage then T3HPage=T2HPage;
else if 0<T3HPage<T1HPage then T3HPage=T1HPage;

```

```

HPage=min(T1HPage, T2HPage, T3HPage);

```

```

array THP[3] T1hypertension T2hypertension T3hypertension;

```

```

recn=0; /*preset recn=0*/

```

```

do i=1 to 3;

```

```

if HPage=. then do;

```

```

if THP[i]>=0 then recn+1;

```

```

if THP[i]=1 then HPage=Tage[i];

```

```

if 0<HPage=Tage[i] and recn=1 then imputedHPage=1;

```

```

else if 0<HPage=Tage[i] and recn>1 then imputedHPage=2;

```

```

end;

```

```

end;

```

```

/**CHD**/

```

```

T1CHD=max(T1heartattack, T1angina);

```

```

T2CHD=max(T2heartattack, T2angina);

```

```

T3CHD=max(T3heartattack, T3angina);

```

```

T1CHDage=min(T1heartattackage, T1angage);

```

```

T2CHDage=min(T2heartattackage, T2angage);

```

```

T3CHDage=min(T3heartattackage, T3angage);

```

```

CHD_ever=max(T1CHD, T2CHD, T3CHD);

```

```

CHDage=min(heartattackage,angage);

```

```

/*if CHD_ever=. then CHD_ever=0;*/

```

```

/*CVD*/

```

```

T1CVD=max(T1heartattack, T1angina, T1stroke);

```

```

T2CVD=max(T2heartattack, T2angina, T2stroke);

```

```

T3CVD=max(T3heartattack, T3angina, T3stroke);

```

```

T1CVDage=min(T1heartattackage, T1angage, T1strokeage);

```

```

T2CVDage=min(T2heartattackage, T2angage, T2strokeage);

```

```
T3CVDage=min(T3heartattackage, T3angage, T3strokeage);
```

```
CVD_ever=max(T1CVD, T2CVD, T3CVD);
```

```
/******social isolation *****/
```

```
array HH_1[4] n_709_0_0 n_709_1_0 n_709_2_0 n_709_3_0;
```

```
array HH_2[4] T1HH T2HH T3HH T4HH;
```

```
do i= 1 to 4;
```

```
HH_2[i]=HH_1[i];
```

```
if HH_2[i] in (-1,-3) then HH_2[i]= .;
```

```
if HH_2[i]>=2 then HH_2[i]=0;
```

```
end;
```

```
if T1HH ne . then HH_B=T1HH;
```

```
else if T1HH=. and T2HH ne . then HH_B=T2HH;
```

```
else if T1HH=. and T2HH=. and T3HH ne . then HH_B=T3HH;
```

```
else if T1HH=. and T2HH=. and T3HH=. and T4HH ne . then HH_B=T4HH;
```

```
array FF_1[4] n_1031_0_0 n_1031_1_0 n_1031_2_0 n_1031_3_0;
```

```
array FF_2[4] T1FF T2FF T3FF T4FF;
```

```
do i= 1 to 4;
```

```
FF_2[i]=FF_1[i];
```

```
if FF_2[i] in (-1,-3) then FF_2[i]= .;
```

```
if FF_2[i] in (1,2,3,4) then FF_2[i]=0;
```

```
if FF_2[i] in (5,6,7) then FF_2[i]=1;
```

```
end;
```

```
if T1FF ne . then FF_B=T1FF;
```

```
else if T1FF=. and T2FF ne . then FF_B=T2FF;
```

```
else if T1FF=. and T2FF=. and T3FF ne . then FF_B=T3FF;
```

```
else if T1FF=. and T2FF=. and T3FF=. and T4FF ne . then FF_B=T4FF;
```

```
array LSA_1[4] n_6160_0_0 n_6160_1_0 n_6160_2_0 n_6160_3_0;
```

```
array LSA_2[4] T1LSA T2LSA T3LSA T4LSA;
```

```
do i= 1 to 4;
```

```
LSA_2[i]=LSA_1[i];
```



```

if LSA_2[i]=-3 then LSA_2[i]= .;
if LSA_2[i] in (1,2,3,4,5) then LSA_2[i]=0;
if LSA_2[i]=-7 then LSA_2[i]=1;
end;

if T1LSA ne . then LSA_B=T1LSA;
else if T1LSA=. and T2LSA ne . then LSA_B=T2LSA;
else if T1LSA=. and T2LSA=. and T3LSA ne . then LSA_B=T3LSA;
else if T1LSA=. and T2LSA=. and T3LSA=. and T4LSA ne . then LSA_B=T4LSA;
ISO=sum(HH_B,FF_B,LSA_B);

if ISO <1 then ISO=0;
if ISO >=1 then ISO=1;

/*****depression *****/
array de_1[4] n_2050_0_0 n_2050_1_0 n_2050_2_0 n_2050_3_0;
array de_2[4] T1de T2de T3de T4de;
do i= 1 to 4;
de_2[i]=de_1[i];
if de_2[i] in (-1,-3) then de_2[i]= .;
end;

if T1de ne . then de_B=T1de;
else if T1de=. and T2de ne . then de_B=T2de;
else if T1de=. and T2de=. and T3de ne . then de_B=T3de;
else if T1de=. and T2de=. and T3de=. and T4de ne . then de_B=T4de;
if de_B in (1, 2) then dep=1;
if de_B=3 then dep=2;
if de_B=4 then dep=3;

if dep=1 then dep=0;
if dep=2 then dep=1;
if dep=3 then dep=1;

/*****loneliness *****/
array lone_1[4] n_2020_0_0 n_2020_1_0 n_2020_2_0 n_2020_3_0;

```

```

array lone_2[4] T1lo      T2lo      T3lo      T4lo;

do i= 1 to 4;
lone_2[i]=lone_1[i];
if lone_2[i] in (-1,-3) then lone_2[i]= .;
end;

if T1lo ne . then lo_B=T1lo;
else if T1lo=. and T2lo ne . then lo_B=T2lo;
else if T1lo=. and T2lo=. and T3lo ne . then lo_B=T3lo;
else if T1lo=. and T2lo=. and T3lo=. and T4lo ne . then lo_B=T4lo;

```

```

/*****Definition: Hearing loss
*****/

/*****Self-report hearing loss*****/
array HL_1[4] n_2247_0_0 n_2247_1_0 n_2247_2_0 n_2247_3_0;
array HL_2[4] T1HL T2HL T3HL T4HL;

do i= 1 to 4;
HL_2[i]=HL_1[i];
if HL_2[i] in (-1,-3) then HL_2[i]= .;
end;

if T1HL ne . then HL_B=T1HL;
else if T1HL=. and T2HL ne . then HL_B=T2HL;
else if T1HL=. and T2HL=. and T3HL ne . then HL_B=T3HL;
else if T1HL=. and T2HL=. and T3HL=. and T4HL ne . then HL_B=T4HL;

if HL_B=99 then HL_B=1;

/*****SRT HEARING LOSS *****/
/*Speech-reception-threshold (SRT) estimate (left)*/
T1SRTL=n_20019_0_0;
T2SRTL=n_20019_1_0;
T3SRTL=n_20019_2_0;
T4SRTL=n_20019_3_0;

if T1SRTL ne . then SRT_L1=T1SRTL;
else if T1SRTL=. and T2SRTL ne . then SRT_L1=T2SRTL;
else if T1SRTL=. and T2SRTL=. and T3SRTL ne . then SRT_L1=T3SRTL;
else if T1SRTL=. and T2SRTL=. and T3SRTL=. and T4SRTL ne . then SRT_L1=T4SRTL;

if SRT_L1 ne . then do;
if -11.25<=SRT_L1<-5.5 then SRT_L=0;
else if -5.5<=SRT_L1<-3.5 then SRT_L=1;
else if SRT_L1>=-3.5 then SRT_L=2;
end;

```

end;

/*Speech-reception-threshold (SRT) estimate (right)*/

T1SRTR=n_20021_0_0;

T2SRTR=n_20021_1_0;

T3SRTR=n_20021_2_0;

T4SRTR=n_20021_3_0;

```
if T1SRTR ne . then SRT_R1=T1SRTR;
else if T1SRTR=. and T2SRTR ne . then SRT_R1=T2SRTR;
else if T1SRTR=. and T2SRTR=. and T3SRTR ne . then SRT_R1=T3SRTR;
else if T1SRTR=. and T2SRTR=. and T3SRTR=. and T4SRTR ne . then
SRT_R1=T4SRTR;
```

```
if SRT_R1 ne . then do;
if SRT_R1<-5.5 then SRT_R=0;
else if -5.5<=SRT_R1<-3.5 then SRT_R=1;
else if SRT_R1>=-3.5 then SRT_R=2;
end;
```

/****** HEARING LOSS (SRT)******/

```
if SRT_L=0 and SRT_R=0 then SRTb=0;
if SRT_L=0 and SRT_R=1 then SRTb=1;
if SRT_L=0 and SRT_R=2 then SRTb=1;
if SRT_L=1 and SRT_R=0 then SRTb=1;
if SRT_L=1 and SRT_R=1 then SRTb=2;
if SRT_L=1 and SRT_R=2 then SRTb=3;
if SRT_L=2 and SRT_R=0 then SRTb=1;
if SRT_L=2 and SRT_R=1 then SRTb=3;
if SRT_L=2 and SRT_R=2 then SRTb=3;
```

/******Intervention: HEARING Aids (HA)******/

/*Self-reported: Hearing aid user*/

T1HA=n_3393_0_0;

```

T2HA=n_3393_1_0;
T3HA=n_3393_2_0;
T4HA=n_3393_3_0;
if T1HA<0 and T2HA<0 and T3HA<0 and T4HA<0 then HA=.;
else if T1HA=1 or T2HA=1 or T3HA=1 or T4HA=1 then HA=1;
else HA=0;

/*****hearing loss+ with/without HA*****/
/*****self-report hearing loss +HA*****/
if HL_B=0 and HA=0 then X_a=0;/**normal**/
if HL_B=1 and HA=0 then X_a=1; /** without HA**/
if HL_B=1 and HA=1 then X_a=2; /** with HA**/

/*****SRTb+HA*****/
if SRTb=0 and HA=0 then X_b=0;/**normal**/
if SRTb=1 and HA=0 then X_b=1; /**UHL+without HA**/
if SRTb=1 and HA=1 then X_b=2; /**UHL+with HA**/
if SRTb=2 and HA=0 then X_b=3; /**moderate+without HA**/
if SRTb=2 and HA=1 then X_b=4; /**moderate+with HA**/
if SRTb=3 and HA=0 then X_b=5;/**severe+without HA**/
if SRTb=3 and HA=1 then X_b=6; /**severe+with HA**/

```

/******Definition:UKB_dementia*****

*****/

deathyear=year(s_40000_0_0);
age_deathyear=deathyear-birthyear;

/*****age-follow up*****/

if deathyear=. then agelastfollow_n=2022-birthyear;
if deathyear>0 then agelastfollow_n=age_deathyear;

/*****All cause dementia*****/

UKB_Dementia_Year=year(s_42018_0_0);
if UKB_Dementia_Year>0 then UKB_all_cause_dementia=1;
else if UKB_Dementia_Year=. then UKB_all_cause_dementia=0;
Age_UKB_all_dementia=UKB_Dementia_Year-birthyear;

/*****AD*****/

UKB_AD_Year=year(s_42020_0_0);
if UKB_AD_Year>0 then UKB_AD=1;
else if UKB_AD_Year=. then UKB_AD=0;

/*****VD*****/

UKB_VD_Year=year(s_42022_0_0);
if UKB_VD_Year>0 then UKB_VD=1;
else if UKB_VD_Year=. then UKB_VD=0;

/*****NAVD*****/

if UKB_all_cause_dementia=0 then NAVD=0;
if UKB_all_cause_dementia=1 and (UKB_AD=1 or UKB_VD=1) then NAVD=0;
else if UKB_all_cause_dementia=1 and (UKB_AD=0 and UKB_VD=0) then
NAVD=UKB_all_cause_dementia-UKB_AD-UKB_VD;

/*follow up duration*/

if UKB_all_cause_dementia=0 then Follow_up_duration=2022-T1year;
if UKB_all_cause_dementia=0 and age_deathyear>0 then
Follow_up_duration=age_deathyear-T1age;
else if UKB_all_cause_dementia=1 then Follow_up_duration=Age_UKB_all_dementia-T1age;

```

    if UKB_AD=0 then Follow_up_duration_AD=2022-T1year;
    if UKB_AD=0 and age_deathyear>0 then Follow_up_duration_AD=age_deathyear-
T1age;
else if UKB_AD=1 then Follow_up_duration_AD=Age_UKB_all_dementia-T1age;

    if UKB_VD=0 then Follow_up_duration_VD=2022-T1year;
    if UKB_VD=0 and age_deathyear>0 then Follow_up_duration_VD=age_deathyear-
T1age;
else if UKB_VD=1 then Follow_up_duration_VD=Age_UKB_all_dementia-T1age;

    if NAVD=0 then Follow_up_duration_NAVD=2022-T1year;
    if NAVD=0 and age_deathyear>0 then Follow_up_duration_NAVD=age_deathyear-
T1age;
else if NAVD=1 then Follow_up_duration_NAVD=Age_UKB_all_dementia-T1age;
/*****death risk*****/

if UKB_all_cause_dementia=1 then event_All=1;
if UKB_all_cause_dementia=0 and age_deathyear>0 then event_All=2;
if UKB_all_cause_dementia=0 and age_deathyear<0 then event_All=0;

if UKB_AD=1 then event_AD=1;
if UKB_AD=0 and age_deathyear>0 then event_AD=2;
if UKB_AD=0 and age_deathyear<0 then event_AD=0;

if UKB_VD=1 then event_VD=1;
if UKB_VD=0 and age_deathyear>0 then event_VD=2;
if UKB_VD=0 and age_deathyear<0 then event_VD=0;

if NAVD=1 then event_NAVD=1;
if NAVD=0 and age_deathyear>0 then event_NAVD=2;
if NAVD=0 and age_deathyear<0 then event_NAVD=0;

run;

```

```

Data UKB.hearing_2023_HL;
set UKB.hearing_2023_2;
/*****Definition: excluded
participants*****/

if UKB_all_cause_dementia=1 and Age_UKB_all_dementia<=T1age then delete;
run;    /**502166****Dementia at baseline=223**/

```

```

Data UKB.hearing_2023_HL;
set UKB.hearing_2023_HL;

if HL_B=. then delete;
run;    /**480280*People without self-reported hearing loss **/

```

```

Data UKB.hearing_2023_HL;
set UKB.hearing_2023_HL;

if HA=. then delete;
run;    /**321219**People without hearing aids use */

```

```

Data UKB.hearing_2023_HL;
set UKB.hearing_2023_HL;

if X_a=. then delete;
run;    /**319658*People who were self-reported normal hearing using hearing aids **/

```

```

Data UKB.hearing_2023_HL;
set UKB.hearing_2023_HL;
if race_X=.
or education1=.
or n_31_0_0=.
or income=.
or TS=.

```



```
or bmi4group_b=.
or smoking_B=.
or PA_level=.
or diab_ever=.
or T1age_c=.
or hypertension_ever=.
or CVD_ever=.
or APOE_status=.
or AC_C=.
or Dementia_family_history=.
or ISO=.
or dep=.
or lo_B=.
then delete;
run;  /**281371*With missing information**/
```

/*****Characteristic : self-report Hearing loss + hearing aids (HA)*****/

```
proc tabulate data=UKB.hearing_2023_HL;  
class X_a T1age_c n_31_0_0 race_X education1 income TS  
Dementia_family_history bmi4group_b smoking_B AC_C PA_level  
diab_ever hypertension_ever CVD_ever APOE_status ISO dep lo_B ;  
table (X_a T1age_c n_31_0_0 race_X education1 income TS Dementia_family_history  
bmi4group_b smoking_B AC_C PA_level  
diab_ever hypertension_ever CVD_ever APOE_status ISO dep lo_B ), X_a*(n  
rowpctn="%")all;  
run;
```

```
proc tabulate data=UKB.hearing_2023_HL;  
class X_a T1age_c n_31_0_0 race_X education1 income TS Dementia_family_history  
bmi4group_b smoking_B AC_C PA_level  
diab_ever hypertension_ever CVD_ever APOE_status ISO dep lo_B  
UKB_all_cause_dementia;  
table (X_a T1age_c n_31_0_0 race_X education1 income TS Dementia_family_history  
bmi4group_b smoking_B AC_C PA_level  
diab_ever hypertension_ever CVD_ever APOE_status ISO dep lo_B ),  
UKB_all_cause_dementia*(n rowpctn="%")all;  
run;
```

```

/*****Cox: self-report HL+HA: dementia Model 1-4*****/
/***** self-report HL+HA: All-cause dementia*****/
proc freq data=UKB.hearing_2023_HL; Table X_a*UKB_all_cause_dementia/norow nocol
nopercent;run;

/*Model 1*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref)
T1age_c ;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_a T1age_c
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 2*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref) T1age_c
race_X education1 n_31_0_0 TS income Dementia_family_history;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_a T1age_c race_X
education1 n_31_0_0 TS income Dementia_family_history

/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 3*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref) race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C
Dementia_family_history

PA_level T1age_c ;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_a race_X education1
n_31_0_0 TS income bmi4group_b smoking_B AC_C Dementia_family_history

PA_level T1age_c
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;

```

```

/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 4*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref)                                race_X
education1  n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C
Dementia_family_history

PA_level  T1age_c  diab_ever  hypertension_ever  CVD_ever  APOE_status  ;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_a      race_X  education1
n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C  Dementia_family_history

PA_level      T1age_c  diab_ever  hypertension_ever  CVD_ever  APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/***** self-report HL+HA: AD*****/
/*Model 1*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref)
T1age_c  ;
model Follow_up_duration_AD*UKB_AD(0) =X_a      T1age_c
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 2*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref)                                T1age_c
race_X  education1  n_31_0_0  TS  income  Dementia_family_history;
model Follow_up_duration_AD*UKB_AD(0) =X_a      T1age_c  race_X  education1
n_31_0_0  TS  income      Dementia_family_history

/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/

```

```

run;

/*Model 3*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref)                                race_X
education1  n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C
Dementia_family_history

PA_level  T1age_c  ;
model Follow_up_duration_AD*UKB_AD(0) =X_a  race_X  education1  n_31_0_0
TS  income  bmi4group_b  smoking_B  AC_C  Dementia_family_history

PA_level  T1age_c
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 4*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref)                                race_X
education1  n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C
Dementia_family_history

PA_level  T1age_c  diab_ever  hypertension_ever  CVD_ever  APOE_status  ;
model Follow_up_duration_AD*UKB_AD(0) =X_a  race_X  education1  n_31_0_0
TS  income  bmi4group_b  smoking_B  AC_C  Dementia_family_history

PA_level  T1age_c  diab_ever  hypertension_ever  CVD_ever  APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/***** self-report HL+HA: VD*****/
/*Model 1*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref)
T1age_c  ;

```

```

model Follow_up_duration_VD*UKB_VD(0) =X_a          T1age_c
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 2*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref)                                T1age_c
race_X  education1  n_31_0_0  TS  income  Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_a  T1age_c  race_X  education1
n_31_0_0  TS  income  Dementia_family_history

/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 3*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref)                                race_X
education1  n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C
Dementia_family_history

PA_level  T1age_c  ;
model Follow_up_duration_VD*UKB_VD(0) =X_a  race_X  education1  n_31_0_0
TS  income  bmi4group_b  smoking_B  AC_C  Dementia_family_history

PA_level  T1age_c
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 4*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref)                                race_X
education1  n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C
Dementia_family_history

```

```

PA_level T1age_c diab_ever hypertension_ever CVD_ever APOE_status ;
model Follow_up_duration_VD*UKB_VD(0) =X_a race_X education1 n_31_0_0
TS income bmi4group_b smoking_B AC_C Dementia_family_history

```

```

PA_level T1age_c diab_ever hypertension_ever CVD_ever APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/***** self-report HL+HA: NAVD*****/
/*Model 1*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref)
T1age_c ;
model Follow_up_duration_NAVD*NAVD(0) =X_a T1age_c
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*Model 2*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref) T1age_c
race_X education1 n_31_0_0 TS income Dementia_family_history;
model Follow_up_duration_NAVD*NAVD(0) =X_a T1age_c race_X education1
n_31_0_0 TS income Dementia_family_history

/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*Model 3*/
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
class X_a(ref="0" param=ref) race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C
Dementia_family_history

PA_level T1age_c ;

```

```
model Follow_up_duration_NAVD*NAVD(0) =X_a      race_X  education1  n_31_0_0
TS income  bmi4group_b  smoking_B  AC_C  Dementia_family_history
```

```
PA_level      T1age_c
```

```
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
```

```
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
```

```
run;
```

```
/*Model 4*/
```

```
Proc phreg data=UKB.hearing_2023_HL; /*plots(overlay)=survival*/
```

```
class X_a(ref="0" param=ref)
```

```
race_X
```

```
education1  n_31_0_0  TS income  bmi4group_b  smoking_B  AC_C
```

```
Dementia_family_history
```

```
PA_level      T1age_c  diab_ever  hypertension_ever  CVD_ever  APOE_status  ;
```

```
model Follow_up_duration_NAVD*NAVD(0) =X_a      race_X  education1  n_31_0_0
```

```
TS income  bmi4group_b  smoking_B  AC_C  Dementia_family_history
```

```
PA_level      T1age_c  diab_ever  hypertension_ever  CVD_ever  APOE_status
```

```
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
```

```
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
```

```
run;
```



```

/*****SRT hearing loss & with or without HA*****/
/*****SRT hearing loss*****/
Data UKB.hearing_2023_2a;
set UKB.hearing_2023_HL;
if SRTb=. then delete;
run; /**178295**People without SiN hearing test */

Data UKB.hearing_2023_2a;
set UKB.hearing_2023_2a;
if 60<=T1age<64 then T1age_new=0;else T1age_new=1;run;

/*****SRT hearing loss+hearing aids use*****/
Data UKB.hearing_2023_2b;
set UKB.hearing_2023_2a;
if X_b=. then delete;
run; /**176629*People who were with normal SiN hearing and used hearing aids ***/

proc freq data=UKB.hearing_2023_2b; where T1age>=60;Table T1age /norow nocol
nopercnt;run; /**73266*People included in the SiN hearing analysis***/

/***** Characteristic : SRT hearing loss +hearing aids*****/
proc tabulate data=UKB.hearing_2023_2b;
where T1age>=60;
class X_b n_31_0_0 race_X education1 income TS Dementia_family_history
bmi4group_b smoking_B AC_C PA_level
diab_ever hypertension_ever CVD_ever APOE_status ISO dep lo_B ;
table (X_b n_31_0_0 race_X education1 income TS Dementia_family_history
bmi4group_b smoking_B AC_C PA_level
diab_ever hypertension_ever CVD_ever APOE_status ISO dep lo_B), X_b*(n
rowpctn="%")all;
run;

proc tabulate data=UKB.hearing_2023_2b;
where T1age>=60;
class X_b n_31_0_0 race_X education1 income TS Dementia_family_history
bmi4group_b smoking_B AC_C PA_level
diab_ever hypertension_ever CVD_ever APOE_status ISO dep lo_B

```

```
UKB_all_cause_dementia;  
table (X_b n_31_0_0 race_X education1 income TS Dementia_family_history  
bmi4group_b smoking_B AC_C PA_level  
diab_ever hypertension_ever CVD_ever APOE_status ISO dep lo_B ),  
UKB_all_cause_dementia*(n rowpctn="%")all;  
run;
```

```

/* /*model 1* T1age_new */
/* /*model 2* n_31_0_0 race_X education1 income TS Dementia_family_history */
/* /*model 3* bmi4group_b smoking_B AC_C PA_level */
/* /*model 4* diab_ever hypertension_ever CVD_ever APOE_status */

/*****Cox: SRT hearing loss +HA --All-cause dementia*Model 1-4*****/
proc freq data=UKB.hearing_2023_2b;where T1age>=60; Table
X_b*UKB_all_cause_dementia/norow nocol nopercnt;run;

/*Model 1*/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref)
T1age_new ;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b T1age_new
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 2*/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 n_31_0_0 TS income T1age_new Dementia_family_history;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b race_X education1
n_31_0_0 TS income T1age_new Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 3*/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C

```

```

PA_level T1age_new Dementia_family_history;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b race_X education1
n_31_0_0 TS income bmi4group_b smoking_B AC_C

```

```

PA_level T1age_new Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

/*Model 4*/

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C
Dementia_family_history

```

```

PA_level T1age_new diab_ever hypertension_ever CVD_ever APOE_status ;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b race_X education1
n_31_0_0 TS income bmi4group_b smoking_B AC_C Dementia_family_history

```

```

PA_level T1age_new diab_ever hypertension_ever CVD_ever APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

/****** Cox: SRT hearing loss +HA --AD*Model 1-4** *****/

```

proc freq data=UKB.hearing_2023_2b; where T1age>=60;Table X_b*UKB_AD/norow nocol
nopercent;run;

```

/*Model 1*/

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref)
T1age_new ;
model Follow_up_duration_AD*UKB_AD(0) =X_b T1age_new
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;

```

```
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/  
run;
```

```
/*Model 2*/
```

```
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/  
where T1age>=60;  
class X_b(ref="0" param=ref) race_X  
education1 n_31_0_0 TS income T1age_new Dementia_family_history;  
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X education1 n_31_0_0  
TS income T1age_new Dementia_family_history  
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;  
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/  
run;
```

```
/*Model 3*/
```

```
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/  
where T1age>=60;  
class X_b(ref="0" param=ref) race_X  
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level  
T1age_new Dementia_family_history;  
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X education1 n_31_0_0  
TS income bmi4group_b smoking_B AC_C PA_level T1age_new  
Dementia_family_history  
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;  
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/  
run;
```

```
/*Model 4*/
```

```
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/  
where T1age>=60;  
class X_b(ref="0" param=ref) race_X  
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level  
diab_ever T1age_new hypertension_ever CVD_ever APOE_status  
Dementia_family_history;  
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X education1 n_31_0_0  
TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new  
hypertension_ever CVD_ever APOE_status Dementia_family_history
```

```

/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/***** Cox: SRT hearing loss +HA -VD*Model 1-4** *****/
proc freq data=UKB.hearing_2023_2b; where T1age>=60;Table X_b*UKB_VD/norow nocol
nopercent;run;

/*Model 1*/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref)
T1age_new ;
model Follow_up_duration_VD*UKB_VD(0) =X_b T1age_new
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 2*/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 n_31_0_0 TS income T1age_new Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X education1 n_31_0_0
TS income T1age_new Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 3*/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
T1age_new Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X education1 n_31_0_0
TS income bmi4group_b smoking_B AC_C PA_level T1age_new

```

```

Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 4*/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever APOE_status
Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X education1 n_31_0_0
TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever APOE_status Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/***** Cox: SRT hearing loss +HA --NAVD*Model 1-4** *****/
proc freq data=UKB.hearing_2023_2b; where T1age>=60;Table X_b*NAVD/norow nocol
nopercent;run;

/*Model 1*/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref)
T1age_new ;
model Follow_up_duration_NAVID*NAVID(0) =X_b T1age_new
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 2*/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref) race_X

```

```

education1  n_31_0_0  TS  income  T1age_new  Dementia_family_history;
model Follow_up_duration_NAVD*NAVD(0) =X_b          race_X  education1  n_31_0_0
TS  income  T1age_new  Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 3*/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref)                                race_X
education1  n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C  PA_level
T1age_new  Dementia_family_history;
model Follow_up_duration_NAVD*NAVD(0) =X_b          race_X  education1  n_31_0_0
TS  income  bmi4group_b  smoking_B  AC_C  PA_level  T1age_new
Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*Model 4*/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref)                                race_X
education1  n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C  PA_level
diab_ever  T1age_new  hypertension_ever  CVD_ever  APOE_status
Dementia_family_history;
model Follow_up_duration_NAVD*NAVD(0) =X_b          race_X  education1  n_31_0_0
TS  income  bmi4group_b  smoking_B  AC_C  PA_level  diab_ever  T1age_new
hypertension_ever  CVD_ever  APOE_status  Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```



```

/*****competing risk analysis considering death as a competing event*****/
data UKB.risk;
  X_b=0; output; X_b=1; output; X_b=2; output; X_b=3; output; X_b=4; output;X_b=5;
output;X_b=6; output;
  race_X=1;output; race_X=2; output; race_X=3; output; race_X=4; output;
  education1=1; output;education1=2; output;education1=3; output;
  n_31_0_0=0; output; n_31_0_0=1; output;
  TS=1; output;TS=2; output;TS=3; output;TS=4; output;
  income=1; output;income=2; output;income=3; output;income=4; output;
  bmi4group_b=1; output;bmi4group_b=2; output;bmi4group_b=3; output;bmi4group_b=4; output;
  smoking_B=0; output;smoking_B=1; output;smoking_B=2; output;
  AC_C=1; output;AC_C=2; output;AC_C=3; output;AC_C=4; output;AC_C=5; output;
  PA_level=0; output;PA_level=1; output;PA_level=2; output;
  diab_ever=0; output;diab_ever=1; output;
  T1age_new=1; output;T1age_new=2; output;T1age_new=3; output;
  hypertension_ever=0; output;hypertension_ever=1; output;
  CVD_ever=0; output;CVD_ever=1; output;
  APOE_status=0; output;APOE_status=1; output;APOE_status=2; output;
  Dementia_family_history=0; output;Dementia_family_history=1; output;

```

```

run;
ods graphics on;

```

```

/*****All-cause dementia*****/

```

```

proc phreg data=UKB.hearing_2023_2b plots(overlay=stratum)=cif;
where T1age>=60;
class X_b(ref="0" param=ref) race_X education1 n_31_0_0 TS income bmi4group_b
smoking_B AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status
Dementia_family_history ;
model Follow_up_duration*event_all(0)=X_b race_X education1 n_31_0_0 TS income
bmi4group_b smoking_B AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status
Dementia_family_history/eventcode=1;
Hazardratio 'Pairwise' X_b / diff=pairwise;
baseline covariates=UKB.risk out=UKB.hearing_risk cif=_all_;run;

```

```

/*****AD*****/

```

```

proc phreg data=UKB.hearing_2023_2b plots(overlay=stratum)=cif;
where T1age>=60;
class X_b(ref="0" param=ref) race_X education1 n_31_0_0 TS income bmi4group_b
smoking_B AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status
Dementia_family_history ;
model Follow_up_duration_AD*event_AD(0)=X_b race_X education1 n_31_0_0 TS
income bmi4group_b smoking_B AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status
Dementia_family_history/eventcode=1;
Hazardratio 'Pairwise' X_b / diff=pairwise;
baseline covariates=UKB.risk out=UKB.hearing_risk cif=_all_;run;

```

```

/*****VD*****/

```

```

proc phreg data=UKB.hearing_2023_2b plots(overlay=stratum)=cif;
where T1age>=60;
class X_b(ref="0" param=ref) race_X education1 n_31_0_0 TS income bmi4group_b
smoking_B AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status
Dementia_family_history ;
model Follow_up_duration_VD*event_VD(0)=X_b race_X education1 n_31_0_0 TS
income bmi4group_b smoking_B AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status
Dementia_family_history/eventcode=1;
Hazardratio 'Pairwise' X_b / diff=pairwise;
baseline covariates=UKB.risk out=UKB.hearing_risk cif=_all_;run;

```

```

/*****NAVD*****/

```

```

proc phreg data=UKB.hearing_2023_2b plots(overlay=stratum)=cif;
where T1age>=60;
class X_b(ref="0" param=ref) race_X education1 n_31_0_0 TS income bmi4group_b
smoking_B AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status
Dementia_family_history ;
model Follow_up_duration_NAVD*event_NAVD(0)=X_b race_X education1 n_31_0_0 TS
income bmi4group_b smoking_B AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status

```

```
Dementia_family_history/eventcode=1;  
Hazardratio 'Pairwise' X_b / diff=pairwise;  
baseline covariates=UKB.risk out=UKB.hearing_risk cif=_all;  
run;
```

```
/******participants with dementia diagnosed at least five years after baseline******/
```

```
Data UKB.hearing_2023_2b_DD;
```

```
set UKB.hearing_2023_2b;
```

```
if UKB_all_cause_dementia=1 and Age_UKB_all_dementia-T1age<5 then delete; run;
```

```
proc freq data=UKB.hearing_2023_2b_DD; where T1age>=60;Table
```

```
X_b*UKB_all_cause_dementia/norow nocol nopercen;run;
```

```
/******All-cause dementia******/
```

```
Proc phreg data=UKB.hearing_2023_2b_DD; /*plots(overlay)=survival*/
```

```
where T1age>=60;
```

```
class X_b(ref="0" param=ref) race_X
```

```
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
```

```
diab_ever T1age_new hypertension_ever CVD_ever APOE_status
```

```
Dementia_family_history;
```

```
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b race_X education1
```

```
n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level diab_ever
```

```
T1age_new hypertension_ever CVD_ever APOE_status Dementia_family_history
```

```
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
```

```
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
```

```
run;
```

```
/******AD******/
```

```
Proc phreg data=UKB.hearing_2023_2b_DD; /*plots(overlay)=survival*/
```

```
where T1age>=60;
```

```
class X_b(ref="0" param=ref) race_X
```

```
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
```

```
diab_ever T1age_new hypertension_ever CVD_ever APOE_status
```

```
Dementia_family_history;
```

```
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X education1 n_31_0_0
```

```
TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new
```

```
hypertension_ever CVD_ever APOE_status Dementia_family_history
```

```
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
```

```
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
```

```
run;
```

```

/*****VD*****/
Proc phreg data=UKB.hearing_2023_2b_DD; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref)                                race_X
education1  n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C  PA_level
diab_ever  T1age_new  hypertension_ever  CVD_ever  APOE_status
Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b  race_X  education1  n_31_0_0
TS  income  bmi4group_b  smoking_B  AC_C  PA_level  diab_ever  T1age_new
hypertension_ever  CVD_ever  APOE_status  Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****NAVD*****/
Proc phreg data=UKB.hearing_2023_2b_DD; /*plots(overlay)=survival*/
where T1age>=60;
class X_b(ref="0" param=ref)                                race_X  education1
n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C  PA_level  diab_ever
T1age_new  hypertension_ever  CVD_ever  APOE_status  Dementia_family_history;
model Follow_up_duration_NAVID*NAVID(0) =X_b  race_X  education1  n_31_0_0
TS  income  bmi4group_b  smoking_B  AC_C  PA_level  diab_ever  T1age_new
hypertension_ever  CVD_ever  APOE_status  Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/***** *Mediation Analysis:*****/
Data UKB.hearing_2023_2a;
set UKB.hearing_2023_2a;

/*hearing loss*/
if SRTb in (0,3) then do;
if SRTb=0 then SRT_bM=0; else SRT_bM=1;
end;
run;

/*****loneliness*****/
Proc logistic data=UKB.hearing_2023_2a;
where T1age>=60;
class SRT_bM (ref="0" param=ref) race_X education1 n_31_0_0 TS income
bmi4group_b smoking_B AC_C
PA_level diab_ever
T1age_new hypertension_ever CVD_ever APOE_status Dementia_family_history ISO
dep;
model lo_B (event="1")=SRT_bM race_X education1 n_31_0_0 TS income
bmi4group_b smoking_B AC_C
PA_level diab_ever
T1age_new hypertension_ever CVD_ever APOE_status Dementia_family_history ISO
dep ;
run;

/*****All-cause dementia*****/
Proc logistic data=UKB.hearing_2023_2a ;
where T1age>=60;
class SRT_bM(param=ref ref="0") lo_B(param=ref ref="0") race_X education1
n_31_0_0 TS income bmi4group_b smoking_B AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status
Dementia_family_history ISO dep;
model UKB_all_cause_dementia (event="1")=SRT_bM lo_B race_X education1
n_31_0_0 TS income bmi4group_b smoking_B AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status

```

```
Dementia_family_history ISO dep;  
run;
```

```
/******AD******/
```

```
Proc logistic data=UKB.hearing_2023_2a;  
where T1age>=60;  
    class SRT_bM(param=ref ref="0") lo_B(param=ref ref="0") race_X education1  
n_31_0_0 TS income bmi4group_b smoking_B AC_C
```

```
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status  
Dementia_family_history ISO dep;  
    model UKB_AD (event="1")=SRT_bM lo_B race_X  
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C
```

```
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status  
Dementia_family_history ISO dep;  
run;
```

```
/******VD******/
```

```
Proc logistic data=UKB.hearing_2023_2a ;  
where T1age>=60;  
    class SRT_bM(param=ref ref="0") lo_B(param=ref ref="0") race_X education1  
n_31_0_0 TS income bmi4group_b smoking_B AC_C
```

```
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status  
Dementia_family_history ISO dep;  
    model UKB_VD (event="1")=SRT_bM lo_B race_X  
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C
```

```
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status  
Dementia_family_history ISO dep;  
run;
```

```
/******NAVD******/
```

```
Proc logistic data=UKB.hearing_2023_2a ;  
where T1age>=60;  
    class SRT_bM(param=ref ref="0") lo_B(param=ref ref="0")
```

```

race_X  education1  n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C

PA_level  diab_ever  T1age_new  hypertension_ever  CVD_ever  APOE_status
Dementia_family_history ISO dep;
    model NAVD (event="1")=SRT_bM lo_B race_X  education1  n_31_0_0  TS
income  bmi4group_b  smoking_B  AC_C

```

```

PA_level  diab_ever  T1age_new  hypertension_ever  CVD_ever  APOE_status
Dementia_family_history ISO dep;
run;

```

```

/*****social isolation*****/

```

```

Proc logistic data=UKB.hearing_2023_2a;
where T1age>=60;
    class SRT_bM (ref="0" param=ref)  race_X  education1  n_31_0_0  TS  income
bmi4group_b  smoking_B  AC_C
                                PA_level  diab_ever  T1age_new
hypertension_ever  CVD_ever  APOE_status  Dementia_family_history lo_B dep;
    model ISO (event="1")=SRT_bM  race_X  education1  n_31_0_0  TS  income
bmi4group_b  smoking_B  AC_C
                                PA_level  diab_ever  T1age_new
hypertension_ever  CVD_ever  APOE_status  Dementia_family_history lo_B dep;
run;

```

```

/*****All-cause dementia*****/

```

```

Proc logistic data=UKB.hearing_2023_2a ;
where T1age>=60;
    class SRT_bM(param=ref ref="0")  ISO(param=ref ref="0")
race_X  education1  n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C

PA_level  diab_ever  T1age_new  hypertension_ever  CVD_ever  APOE_status
Dementia_family_history lo_B dep;
    model UKB_all_cause_dementia (event="1")=SRT_bM  ISO  race_X  education1
n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C

PA_level  diab_ever  T1age_new  hypertension_ever  CVD_ever  APOE_status
Dementia_family_history lo_B dep;

```


run;

/******AD******/

Proc logistic data=UKB.hearing_2023_2a ;

where T1age>=60;

class SRT_bM(param=ref ref="0") ISO(param=ref ref="0")

race_X education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C

PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status

Dementia_family_history lo_B dep;

model UKB_AD (event="1")=SRT_bM ISO race_X education1 n_31_0_0 TS

income bmi4group_b smoking_B AC_C

PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status

Dementia_family_history lo_B dep;

run;

/******VD******/

Proc logistic data=UKB.hearing_2023_2a ;

where T1age>=60;

class SRT_bM(param=ref ref="0") ISO(param=ref ref="0")

race_X education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C

PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status

Dementia_family_history lo_B dep;

model UKB_VD (event="1")=SRT_bM ISO race_X education1 n_31_0_0 TS

income bmi4group_b smoking_B AC_C

PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status

Dementia_family_history lo_B dep;

run;

/******NAVD******/

Proc logistic data=UKB.hearing_2023_2a;

where T1age>=60;

class SRT_bM(param=ref ref="0") ISO(param=ref ref="0")

race_X education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C

```

PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status
Dementia_family_history lo_B dep;
    model NAVD (event="1")=SRT_bM ISO race_X education1 n_31_0_0 TS
income bmi4group_b smoking_B AC_C

```

```

PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status
Dementia_family_history lo_B dep;
run;

```

```

/*****depression*****/

```

```

Proc logistic data=UKB.hearing_2023_2a;
where T1age>=60;
    class SRT_bM (ref="0" param=ref) race_X education1 n_31_0_0 TS income
bmi4group_b smoking_B AC_C
                                PA_level diab_ever T1age_new
hypertension_ever CVD_ever APOE_status Dementia_family_history lo_B ISO;
    model dep (event="1")=SRT_bM race_X education1 n_31_0_0 TS income
bmi4group_b smoking_B AC_C
                                PA_level diab_ever T1age_new
hypertension_ever CVD_ever APOE_status Dementia_family_history lo_B ISO;
run;

```

```

/*****All-cause dementia*****/

```

```

Proc logistic data=UKB.hearing_2023_2a;
where T1age>=60;
    class SRT_bM(param=ref ref="0") dep(param=ref ref="0") race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status
Dementia_family_history lo_B ISO;
    model UKB_all_cause_dementia (event="1")=SRT_bM dep race_X education1
n_31_0_0 TS income bmi4group_b smoking_B AC_C

```

```

PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status
Dementia_family_history lo_B ISO;
run;

```

```
/******AD******/
```

```
Proc logistic data=UKB.hearing_2023_2a ;
```

```
where T1age>=60;
```

```
class SRT_bM(param=ref ref="0") dep(param=ref ref="0") race_X education1  
n_31_0_0 TS income bmi4group_b smoking_B AC_C
```

```
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status  
Dementia_family_history lo_B ISO;
```

```
model UKB_AD (event="1")=SRT_bM dep race_X  
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C
```

```
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status  
Dementia_family_history lo_B ISO;
```

```
run;
```

```
/******VD******/
```

```
Proc logistic data=UKB.hearing_2023_2a ;
```

```
where T1age>=60;
```

```
class SRT_bM(param=ref ref="0") dep(param=ref ref="0") race_X education1  
n_31_0_0 TS income bmi4group_b smoking_B AC_C
```

```
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status  
Dementia_family_history lo_B ISO;
```

```
model UKB_VD (event="1")=SRT_bM dep race_X education1 n_31_0_0 TS  
income bmi4group_b smoking_B AC_C
```

```
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status  
Dementia_family_history lo_B ISO;
```

```
run;
```

```
/******NAVD******/
```

```
Proc logistic data=UKB.hearing_2023_2a;
```

```
where T1age>=60;
```

```
class SRT_bM(param=ref ref="0") dep(param=ref ref="0") race_X  
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C
```

```
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status  
Dementia_family_history lo_B ISO;  
    model NAVD (event="1")=SRT_bM dep race_X education1 n_31_0_0 TS  
income bmi4group_b smoking_B AC_C
```

```
PA_level diab_ever T1age_new hypertension_ever CVD_ever APOE_status  
Dementia_family_history lo_B ISO;  
run;
```

```
/******Subgroup analysis******/
```

```
/******Subgroup-sex_female******/
```

```
proc freq data=UKB.hearing_2023_2b;where n_31_0_0=0 and T1age>=60;Table  
X_b*UKB_All_cause_dementia/norow nocol nopercnt;run;
```

```
/******all-cause dementia******/
```

```
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/  
where n_31_0_0=0 and T1age>=60;  
class X_b(ref="0" param=ref) race_X  
education1 TS income bmi4group_b smoking_B AC_C PA_level diab_ever  
T1age_new hypertension_ever CVD_ever APOE_status Dementia_family_history;  
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b race_X education1  
TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new  
hypertension_ever CVD_ever APOE_status Dementia_family_history  
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;  
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/  
run;
```

```
/******AD******/
```

```
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/  
where n_31_0_0=0 and T1age>=60;  
class X_b(ref="0" param=ref) race_X  
education1 TS income bmi4group_b smoking_B AC_C PA_level diab_ever  
T1age_new hypertension_ever CVD_ever APOE_status Dementia_family_history;  
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X education1 TS income  
bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new hypertension_ever  
CVD_ever APOE_status Dementia_family_history  
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;  
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/  
run;
```

```
/******VD******/
```

```
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/  
where n_31_0_0=0 and T1age>=60;  
class X_b(ref="0" param=ref) race_X  
education1 TS income bmi4group_b smoking_B AC_C PA_level diab_ever
```

```

T1age_new hypertension_ever CVD_ever APOE_status Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X education1 TS income
bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new hypertension_ever
CVD_ever APOE_status Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****NAVD*****/

```

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where n_31_0_0=0 and T1age>=60;
class X_b(ref="0" param=ref) race_X education1
TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever APOE_status Dementia_family_history;
model Follow_up_duration_NAVD*NAVD(0) =X_b race_X education1 TS income
bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new hypertension_ever
CVD_ever APOE_status Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****Subgroup-sex_male*****/

```

```

/*****All-cause dementia*****/

```

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where n_31_0_0=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 TS income bmi4group_b smoking_B AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever APOE_status Dementia_family_history;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b race_X education1
TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever APOE_status Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****AD*****/

```

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where n_31_0_0=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 TS income bmi4group_b smoking_B AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever APOE_status Dementia_family_history;
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X education1 TS income
bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new hypertension_ever
CVD_ever APOE_status Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****VD*****/

```

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where n_31_0_0=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 TS income bmi4group_b smoking_B AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever APOE_status Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X education1 TS income
bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new hypertension_ever
CVD_ever APOE_status Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****NAVD*****/

```

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where n_31_0_0=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 TS income bmi4group_b smoking_B AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever APOE_status Dementia_family_history;
model Follow_up_duration_NAVD*NAVD(0) =X_b race_X education1 TS income
bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new hypertension_ever
CVD_ever APOE_status Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****Subgroup-APOE*****/
/*****Subgroup-Non-apoe e4*****/
/*****All-cause dementia*****/
proc freq data=UKB.hearing_2023_2b;where APOE_status=0 and T1age>=60;Table
X_b*UKB_All_cause_dementia/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where APOE_status=0 and T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b race_X education1
n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****AD*****/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where APOE_status=0 and T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X education1 n_31_0_0
TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****VD*****/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where APOE_status=0 and T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X education1 n_31_0_0

```



```

TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****NAVD*****/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where APOE_status=0 and T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_NAVD*NAVD(0) =X_b race_X education1 n_31_0_0
TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****Subgroup-with apoe e4*****/
/*****All-cause dementia*****/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where APOE_status in (1,2) and T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b race_X education1
n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****AD*****/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where APOE_status in (1,2) and T1age>=60;
class X_b(ref="0" param=ref) race_X

```

```

education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X education1 n_31_0_0
TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****VD*****/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where APOE_status in (1,2) and T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X education1 n_31_0_0
TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****NAVD*****/
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where APOE_status in (1,2) and T1age>=60;
class X_b(ref="0" param=ref) race_X
education1 n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_NAVID*NAVID(0) =X_b race_X education1 n_31_0_0
TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/***** Subgroup-education *****/
/*****Subgroup-Group 1 *****/
/*****All-cause dementia *****/

```

```

proc freq data=UKB.hearing_2023_2b;where education1=1 and T1age>=60;Table
X_b*UKB_All_cause_dementia/norow nocol nopercnt;run;

```

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where education1=1 and T1age>=60;
class X_b(ref="0" param=ref)
race_X n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history
APOE_status;
model Follow_up_duration*UKB_All_cause_dementia(0) =X_b race_X n_31_0_0
TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****AD*****/

```

```

proc freq data=UKB.hearing_2023_2b;where education1=1 and T1age>=60;Table
X_b*UKB_AD/norow nocol nopercnt;run;

```

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where education1=1 and T1age>=60;
class X_b(ref="0" param=ref)
race_X n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history
APOE_status;
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X n_31_0_0 TS income
bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new hypertension_ever
CVD_ever Dementia_family_history APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****VD*****/

```

```

proc freq data=UKB.hearing_2023_2b;where education1=1 and T1age>=60;Table
X_b*UKB_VD/norow nocol nopercnt;run;

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where education1=1 and T1age>=60;
class X_b(ref="0" param=ref)
race_X n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history
APOE_status;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X n_31_0_0 TS income
bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new hypertension_ever
CVD_ever Dementia_family_history APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****NAVD*****/
proc freq data=UKB.hearing_2023_2b;where education1=1 and T1age>=60;Table
X_b*NAVD/norow nocol nopercnt;run;

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where education1=1 and T1age>=60;
class X_b(ref="0" param=ref)
race_X n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history
APOE_status;
model Follow_up_duration_NAVID*NAVID(0) =X_b race_X n_31_0_0 TS income
bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new hypertension_ever
CVD_ever Dementia_family_history APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****Subgroup-Group 2*****/
/*****All-cause dementia*****/
proc freq data=UKB.hearing_2023_2b;where education1=2 and T1age>=60;Table
X_b*UKB_All_cause_dementia/norow nocol nopercnt;run;

```

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where education1=2 and T1age>=60;
class X_b(ref="0" param=ref)
race_X n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history
APOE_status;
model Follow_up_duration*UKB_All_cause_dementia(0) =X_b race_X n_31_0_0
TS income bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****AD*****/

```

```

proc freq data=UKB.hearing_2023_2b;where education1=2 and T1age>=60;Table
X_b*UKB_AD/norow nocol nopercen;run;

```

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where education1=2 and T1age>=60;
class X_b(ref="0" param=ref)
race_X n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history
APOE_status;
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X n_31_0_0 TS income
bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new hypertension_ever
CVD_ever Dementia_family_history APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****VD*****/

```

```

proc freq data=UKB.hearing_2023_2b;where education1=2 and T1age>=60;Table
X_b*UKB_VD/norow nocol nopercen;run;

```

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where education1=2 and T1age>=60;
class X_b(ref="0" param=ref)

```

```

race_X    n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C  PA_level
diab_ever  T1age_new  hypertension_ever  CVD_ever  Dementia_family_history
APOE_status;
model Follow_up_duration_VD*UKB_VD(0) =X_b          race_X    n_31_0_0  TS  income
bmi4group_b  smoking_B  AC_C  PA_level  diab_ever  T1age_new  hypertension_ever
CVD_ever  Dementia_family_history APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****NAVD*****/
proc freq data=UKB.hearing_2023_2b;where education1=2 and T1age>=60;Table
X_b*NAVD/norow nocol nopercent;run;

```

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where education1=2 and T1age>=60;
class X_b(ref="0" param=ref)
race_X    n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C  PA_level
diab_ever  T1age_new  hypertension_ever  CVD_ever  Dementia_family_history
APOE_status;
model Follow_up_duration_NAVID*NAVID(0) =X_b          race_X    n_31_0_0  TS  income
bmi4group_b  smoking_B  AC_C  PA_level  diab_ever  T1age_new  hypertension_ever
CVD_ever  Dementia_family_history APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****Subgroup-Group 3*****/
/*****All-cause dementia*****/
proc freq data=UKB.hearing_2023_2b;where education1=3 and T1age>=60;Table
X_b*UKB_All_cause_dementia/norow nocol nopercent;run;

```

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where education1=3 and T1age>=60;
class X_b(ref="0" param=ref)
race_X    n_31_0_0  TS  income  bmi4group_b  smoking_B  AC_C  PA_level
diab_ever  T1age_new  hypertension_ever  CVD_ever  Dementia_family_history

```

```

APOE_status;
model Follow_up_duration*UKB_All_cause_dementia(0) =X_b          race_X          n_31_0_0
TS income  bmi4group_b  smoking_B  AC_C  PA_level  diab_ever  T1age_new
hypertension_ever  CVD_ever  Dementia_family_history APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****AD*****/

proc freq data=UKB.hearing_2023_2b;where education1=3 and T1age>=60;Table
X_b*UKB_AD/norow nocol nopercent;run;

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where education1=3 and T1age>=60;
class X_b(ref="0" param=ref)
race_X          n_31_0_0  TS income  bmi4group_b  smoking_B  AC_C  PA_level
diab_ever  T1age_new  hypertension_ever  CVD_ever  Dementia_family_history
APOE_status;
model Follow_up_duration_AD*UKB_AD(0) =X_b          race_X          n_31_0_0  TS income
bmi4group_b  smoking_B  AC_C  PA_level  diab_ever  T1age_new  hypertension_ever
CVD_ever  Dementia_family_history APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****VD*****/

proc freq data=UKB.hearing_2023_2b;where education1=3 and T1age>=60;Table
X_b*UKB_VD/norow nocol nopercent;run;

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where education1=3 and T1age>=60;
class X_b(ref="0" param=ref)
race_X          n_31_0_0  TS income  bmi4group_b  smoking_B  AC_C  PA_level
diab_ever  T1age_new  hypertension_ever  CVD_ever  Dementia_family_history
APOE_status;
model Follow_up_duration_VD*UKB_VD(0) =X_b          race_X          n_31_0_0  TS income
bmi4group_b  smoking_B  AC_C  PA_level  diab_ever  T1age_new  hypertension_ever

```

```

CVD_ever  Dementia_family_history APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****NAVD*****/
proc freq data=UKB.hearing_2023_2b;where education1=3 and T1age>=60;Table
X_b*NAVD/norow nocol nopercen;run;

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where education1=3 and T1age>=60;
class X_b(ref="0" param=ref)
race_X n_31_0_0 TS income bmi4group_b smoking_B AC_C PA_level
diab_ever T1age_new hypertension_ever CVD_ever Dementia_family_history
APOE_status;
model Follow_up_duration_NAVD*NAVD(0) =X_b race_X n_31_0_0 TS income
bmi4group_b smoking_B AC_C PA_level diab_ever T1age_new hypertension_ever
CVD_ever Dementia_family_history APOE_status
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```



```

/*****Subgroup: income*****/
/*****Subgroup-income 1*****/
/*****All-cause dementia*****/
proc freq data=UKB.hearing_2023_2b; where income=1 and T1age>=60;Table
X_b*UKB_all_cause_dementia/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X
apoe_status n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C
PA_level T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b race_X apoe_status
n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level
T1age_new hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/run;

/*****AD*****/
proc freq data=UKB.hearing_2023_2b; where income=1 and T1age>=60;Table
X_b*UKB_AD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X apoe_status n_31_0_0
TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/run;

/*****VD*****/
proc freq data=UKB.hearing_2023_2b; where income=1 and T1age>=60;Table
X_b*UKB_VD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level

```

```

T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X apoe_status n_31_0_0
TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/run;

/*****NAVD*****/
proc freq data=UKB.hearing_2023_2b; where income=1 and T1age>=60;Table
X_b*NAVD/norow nocol nopercent;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_NAVD*NAVD(0) =X_b race_X apoe_status n_31_0_0
TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/run;

/*****Subgroup-income 2*****/
/*****All-cause dementia*****/
proc freq data=UKB.hearing_2023_2b; where income=2 and T1age>=60;Table
X_b*UKB_all_cause_dementia/norow nocol nopercent;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=2 and T1age>=60;
class X_b(ref="0" param=ref) race_X
apoe_status n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C
PA_level T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b race_X apoe_status
n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level
T1age_new hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/run;

/*****AD*****/

```

```

proc freq data=UKB.hearing_2023_2b; where income=2 and T1age>=60;Table
X_b*UKB_AD/norow nocol nopercnt;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=2 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X apoe_status n_31_0_0
TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/run;

```

/******VD******/

```

proc freq data=UKB.hearing_2023_2b; where income=2 and T1age>=60;Table
X_b*UKB_VD/norow nocol nopercnt;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=2 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X apoe_status n_31_0_0
TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

/******NAVD******/

```

proc freq data=UKB.hearing_2023_2b; where income=2 and T1age>=60;Table
X_b*NAVD/norow nocol nopercnt;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=2 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_NAVID*NAVID(0) =X_b race_X apoe_status n_31_0_0

```

```

TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****Subgroup-income 3*****/
/*****All-cause dementia*****/
proc freq data=UKB.hearing_2023_2b; where income=3 and T1age>=60;Table
X_b*UKB_all_cause_dementia/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=3 and T1age>=60;
class X_b(ref="0" param=ref) race_X
apoe_status n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C
PA_level T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b race_X apoe_status
n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level
T1age_new hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****AD*****/
proc freq data=UKB.hearing_2023_2b; where income=3 and T1age>=60;Table
X_b*UKB_AD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=3 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X apoe_status n_31_0_0
TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****VD*****/
proc freq data=UKB.hearing_2023_2b; where income=3 and T1age>=60;Table
X_b*UKB_VD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=3 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X apoe_status n_31_0_0
TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****NAVD*****/
proc freq data=UKB.hearing_2023_2b; where income=3 and T1age>=60;Table
X_b*NAVD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=3 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_NAVID*NAVID(0) =X_b race_X apoe_status n_31_0_0
TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****Subgroup-income 4*****/
/*****All-cause dementia*****/
proc freq data=UKB.hearing_2023_2b; where income=4 and T1age>=60;Table
X_b*UKB_all_cause_dementia/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=4 and T1age>=60;
class X_b(ref="0" param=ref) race_X

```

```

apoe_status  n_31_0_0  TS  diab_ever education1  bmi4group_b  smoking_B  AC_C
PA_level  T1age_new  hypertension_ever  CVD_ever  Dementia_family_history;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b  race_X  apoe_status
n_31_0_0  TS  diab_ever education1  bmi4group_b  smoking_B  AC_C  PA_level
T1age_new  hypertension_ever  CVD_ever  Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****AD*****/

```

```

proc freq data=UKB.hearing_2023_2b; where income=4 and T1age>=60;Table
X_b*UKB_AD/norow nocol nopercent;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=4 and T1age>=60;
class X_b(ref="0" param=ref)  race_X  apoe_status
n_31_0_0  TS  diab_ever education1  bmi4group_b  smoking_B  AC_C  PA_level
T1age_new  hypertension_ever  CVD_ever  Dementia_family_history;
model Follow_up_duration_AD*UKB_AD(0) =X_b  race_X  apoe_status  n_31_0_0
TS  diab_ever education1  bmi4group_b  smoking_B  AC_C  PA_level  T1age_new
hypertension_ever  CVD_ever  Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****VD*****/

```

```

proc freq data=UKB.hearing_2023_2b; where income=4 and T1age>=60;Table
X_b*UKB_VD/norow nocol nopercent;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=4 and T1age>=60;
class X_b(ref="0" param=ref)  race_X  apoe_status
n_31_0_0  TS  diab_ever education1  bmi4group_b  smoking_B  AC_C  PA_level
T1age_new  hypertension_ever  CVD_ever  Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b  race_X  apoe_status  n_31_0_0
TS  diab_ever education1  bmi4group_b  smoking_B  AC_C  PA_level  T1age_new
hypertension_ever  CVD_ever  Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/

```

```

run;

/*****NAVD*****/
proc freq data=UKB.hearing_2023_2b; where income=4 and T1age>=60;Table
X_b*NAVD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where income=4 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_NAVD*NAVD(0) =X_b race_X apoe_status n_31_0_0
TS diab_ever education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****Subgroup : smoking status*****/
/*****Subgroup-never smoking*****/
/*****All-cause dementia*****/
proc freq data=UKB.hearing_2023_2b; where smoking_B=0 and T1age>=60; Table
X_b*UKB_All_cause_dementia/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where smoking_B=0 and T1age>=60;
class X_b(ref="0" param=ref)
race_X apoe_status n_31_0_0 TS income education1 bmi4group_b AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever
Dementia_family_history;
model Follow_up_duration*UKB_All_cause_dementia(0) =X_b race_X apoe_status
n_31_0_0 TS income education1 bmi4group_b AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****AD*****/
proc freq data=UKB.hearing_2023_2b; where smoking_B=0 and T1age>=60;Table
X_b*UKB_AD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where smoking_B=0 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS income education1 bmi4group_b AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X apoe_status n_31_0_0
TS income education1 bmi4group_b AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****VD*****/
proc freq data=UKB.hearing_2023_2b; where smoking_B=0 and T1age>=60;Table
X_b*UKB_VD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/

```



```

where smoking_B=0 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS income education1 bmi4group_b AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X apoe_status n_31_0_0
TS income education1 bmi4group_b AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****NAVD*****/

```

```

proc freq data=UKB.hearing_2023_2b; where smoking_B=0 and T1age>=60; Table
X_b*NAVD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where smoking_B=0 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS income education1 bmi4group_b AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_NAVD*NAVD(0) =X_b race_X apoe_status n_31_0_0
TS income education1 bmi4group_b AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****Subgroup-previous smoking*****/

```

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/*****All-cause dementia*****/

```

```

proc freq data=UKB.hearing_2023_2b; where smoking_B=1 and T1age>=60; Table
X_b*UKB_All_cause_dementia/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where smoking_B=1 and T1age>=60;
class X_b(ref="0" param=ref)
race_X apoe_status n_31_0_0 TS income education1 bmi4group_b AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever
Dementia_family_history;
model Follow_up_duration*UKB_All_cause_dementia(0) =X_b race_X apoe_status

```

```

n_31_0_0 TS income education1 bmi4group_b AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****AD*****/

```

```

proc freq data=UKB.hearing_2023_2b; where smoking_B=1 and T1age>=60;Table
X_b*UKB_AD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where smoking_B=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS income education1 bmi4group_b AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X apoe_status n_31_0_0
TS income education1 bmi4group_b AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****VD*****/

```

```

proc freq data=UKB.hearing_2023_2b; where smoking_B=1 and T1age>=60;Table
X_b*UKB_VD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where smoking_B=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS income education1 bmi4group_b AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X apoe_status n_31_0_0
TS income education1 bmi4group_b AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****NAVD*****/

```

```

proc freq data=UKB.hearing_2023_2b; where smoking_B=1 and T1age>=60;Table
X_b*NAVD/norow nocol nopercnt;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where smoking_B=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS income education1 bmi4group_b AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_NAVID*NAVID(0) =X_b race_X apoe_status n_31_0_0
TS income education1 bmi4group_b AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****Subgroup-current smoking*****/
/*****All-cause dementia*****/

```

```

proc freq data=UKB.hearing_2023_2b; where smoking_B=2 and T1age>=60; Table
X_b*UKB_All_cause_dementia/norow nocol nopercnt;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where smoking_B=2 and T1age>=60;
class X_b(ref="0" param=ref)
race_X apoe_status n_31_0_0 TS income education1 bmi4group_b AC_C
PA_level diab_ever T1age_new hypertension_ever CVD_ever
Dementia_family_history;
model Follow_up_duration*UKB_All_cause_dementia(0) =X_b race_X apoe_status
n_31_0_0 TS income education1 bmi4group_b AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****AD*****/

```

```

proc freq data=UKB.hearing_2023_2b; where smoking_B=2 and T1age>=60;Table
X_b*UKB_AD/norow nocol nopercnt;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where smoking_B=2 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status

```

```

n_31_0_0 TS income education1 bmi4group_b AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X apoe_status n_31_0_0
TS income education1 bmi4group_b AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****VD*****/
proc freq data=UKB.hearing_2023_2b; where smoking_B=2 and T1age>=60;Table
X_b*UKB_VD/norow nocol nopercent;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where smoking_B=2 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS income education1 bmi4group_b AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X apoe_status n_31_0_0
TS income education1 bmi4group_b AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****NAVD*****/
proc freq data=UKB.hearing_2023_2b; where smoking_B=2 and T1age>=60;Table
X_b*NAVD/norow nocol nopercent;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where smoking_B=2 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status
n_31_0_0 TS income education1 bmi4group_b AC_C PA_level diab_ever
T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_NAVD*NAVD(0) =X_b race_X apoe_status n_31_0_0
TS income education1 bmi4group_b AC_C PA_level diab_ever T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/run;

```

```

/*****Subgroup : diabetes*****/
/*****Subgroup-no diabetes*****/
/*****All-cause dementia*****/
proc freq data=UKB.hearing_2023_2b; where diab_ever =0 and T1age>=60;Table
X_b*UKB_all_cause_dementia/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where diab_ever=0 and T1age>=60;
class X_b(ref="0" param=ref) race_X
apoe_status n_31_0_0 TS income education1 bmi4group_b smoking_B AC_C
PA_level T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b race_X apoe_status
n_31_0_0 TS income education1 bmi4group_b smoking_B AC_C PA_level
T1age_new hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****AD*****/
proc freq data=UKB.hearing_2023_2b; where diab_ever =0 and T1age>=60;Table
X_b*UKB_AD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where diab_ever=0 and T1age>=60;
class X_b(ref="0" param=ref) race_X
apoe_status n_31_0_0 TS income education1 bmi4group_b smoking_B AC_C
PA_level T1age_new hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X apoe_status n_31_0_0
TS income education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

```

```

/*****VD*****/
proc freq data=UKB.hearing_2023_2b; where diab_ever =0 and T1age>=60;Table
X_b*UKB_VD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where diab_ever=0 and T1age>=60;

```

```

class X_b(ref="0" param=ref)                                race_X  apoe_status
n_31_0_0  TS  income education1  bmi4group_b  smoking_B  AC_C  PA_level
T1age_new  hypertension_ever  CVD_ever  Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b                race_X  apoe_status  n_31_0_0
TS  income  education1  bmi4group_b  smoking_B  AC_C  PA_level  T1age_new
hypertension_ever  CVD_ever  Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****NAVD*****/
proc freq data=UKB.hearing_2023_2b;  where diab_ever =0 and  T1age>=60;Table
X_b*NAVD/norow nocol nopercnt;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where diab_ever=0 and  T1age>=60;
class X_b(ref="0" param=ref)  race_X  apoe_status  n_31_0_0  TS  income education1
bmi4group_b  smoking_B  AC_C  PA_level  T1age_new  hypertension_ever  CVD_ever
Dementia_family_history;
model Follow_up_duration_NAVD*NAVD(0) =X_b                race_X  apoe_status  n_31_0_0
TS  income  education1  bmi4group_b  smoking_B  AC_C  PA_level  T1age_new
hypertension_ever  CVD_ever  Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****Subgroup-with diabetes*****/
/*****All-cause dementia*****/
proc freq data=UKB.hearing_2023_2b;  where diab_ever =1 and  T1age>=60;Table
X_b*UKB_all_cause_dementia/norow nocol nopercnt;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where diab_ever=1 and  T1age>=60;
class X_b(ref="0" param=ref)  race_X  apoe_status  n_31_0_0  TS  income
education1  bmi4group_b  smoking_B  AC_C  PA_level  T1age_new
hypertension_ever  CVD_ever  Dementia_family_history;
model Follow_up_duration*UKB_all_cause_dementia(0) =X_b                race_X  apoe_status
n_31_0_0  TS  income  education1  bmi4group_b  smoking_B  AC_C  PA_level
T1age_new  hypertension_ever  CVD_ever  Dementia_family_history

```

```

/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****AD*****/
proc freq data=UKB.hearing_2023_2b; where diab_ever =1 and T1age>=60;Table
X_b*UKB_AD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where diab_ever=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status n_31_0_0 TS income
education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_AD*UKB_AD(0) =X_b race_X apoe_status n_31_0_0
TS income education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****VD*****/
proc freq data=UKB.hearing_2023_2b; where diab_ever =1 and T1age>=60;Table
X_b*UKB_VD/norow nocol nopercen;run;
Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where diab_ever=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status n_31_0_0 TS income
education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history;
model Follow_up_duration_VD*UKB_VD(0) =X_b race_X apoe_status n_31_0_0
TS income education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/
run;

/*****NAVD*****/
proc freq data=UKB.hearing_2023_2b; where diab_ever =1 and T1age>=60;Table
X_b*NAVD/norow nocol nopercen;run;

```

```

Proc phreg data=UKB.hearing_2023_2b; /*plots(overlay)=survival*/
where diab_ever=1 and T1age>=60;
class X_b(ref="0" param=ref) race_X apoe_status n_31_0_0 TS income education1
bmi4group_b smoking_B AC_C PA_level T1age_new hypertension_ever CVD_ever
Dementia_family_history;
model Follow_up_duration_NAVD*NAVD(0) =X_b race_X apoe_status n_31_0_0
TS income education1 bmi4group_b smoking_B AC_C PA_level T1age_new
hypertension_ever CVD_ever Dementia_family_history
/*entry=left_truncation_new*/ ALPHA=0.05 RISKLIMITS=wald;
/*baseline covariates=covs out=base survival=_all_/ rowid=menoage6c;*/run;

```