

Supplemental Appendix W
SAS Code for Multiple Imputation and Models

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/**** SAS Code for MI and Models for DRI energy report ****/
/** Indiana University, Biostatistics Consulting Center **/
/** Last revised 10/13/2022 **/

%let mypath=C:\Users\lgolzarr\Indiana University\0365-BCC -
Documents\Projects\Allison, David\DRI Energy;
*%let mypath=C:\Users\sd3\Indiana University\0365-BCC - Documents\Projects\Allison,
David\DRI Energy;

libname cleandf "&mypath.\Data\Clean data for analysis";
%let date=13OCT2022; *Set date of most recent data files to use;

/*****
*****/
/***** ALL DATA *****/
/*****
*****/

/* This section imports the clean SAS data alldata_clean_[date]
   These were cleaned with the syntax file "cleaning data [date].sas".
   That syntax combined data from all sources (IOM, IAEA, etc) and removed or
   truncated people with invalid PAL <1 or >2.5.
*/
/*****
/* All data. df=data frame*/ *n=8600;
data df;
    set cleandf.alldata_clean_&date.;
    drop PAL_obs_est PALCAT_obs_est; *Dropped here because needed for clean
analysis output;
run;

* Clean data should have removed or truncated PAL<1 and PAL>2.5;
proc means data=df;
    var PAL;
run;
proc freq data=df;
    tables PALCAT;
run;

* Quick descriptives;
proc means data=df;
    var TEE age height weight FFM FM BEE BMR_kcal_Schofield PAL PAL_est;
run;
* BEE, and therefore PAL, is available on less than half of the data (3421 of 8054);

*** MI MI MI MI MI MI MI MI MI
*****/

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*****;
* Multiple imputation is used to fill in ALL missing data - but especially BEE and
PAL;
* Pctmissing says to perform 20 imputations if 20 percent or more of the data are
missing.
  Because we have more than 50% missing on BEE and PAL then 20 imputations are
performed;
* Note that we considered bounding PAL to 1 to 2.5, but decided to fix these after;
proc mi data=df nimpute=pctmissing(min=5 max=20) out=outmi seed=5849975;
  mcmc chain=multiple ;
  *We consider bounding PAL to be 1 to 2.5 in the imputation;
  *minimum=0 10.77 151.33 1.80 0.1 263 2.36 46.40 1 99.67 1
  maximum=101 61.70 5555.39 97.81 99.9 3035 215.70 202.50 2.5 3347.66 2.5;
  *var Age BMI TEE FFM Percentile BEE Weight Height PAL BMR_kcal_Schofield
PAL_est;
run;
* Note that this doesnt impute for character class ;
* Also dummy vars are imputed with decimal levels, but we dont need them for
analysis either (but using dummies to help impute other data);
* outmi n= 8600 x 20 = 172,000 ;

/*Check for PAL<1 or >2.5 after imputation*/
proc means data=outmi;
  var PAL;
run;

/*Calculate PAL categories*/
/* The continuous PAL score was imputed, but need to put them in buckets */
data outmi2; set outmi; *n=172040 ;
  format PALCAT $10.;
  if .<age<9.0 then do; *3.0<=age<9.0;
    if .<PAL<1 then PALCAT='PAL<1';
    if 1.0<=PAL<1.31 then PALCAT='S';
    if 1.31<=PAL<1.44 then PALCAT='LA';
    if 1.44<=PAL<1.59 then PALCAT='A';
    if 1.59<=PAL<2.5 then PALCAT='VA';
    if 2.5<=PAL then PALCAT='PAL>2.5';
  end;
  if 9.0<=age<14.0 then do;
    if .<PAL<1 then PALCAT='PAL<1';
    if 1.0<=PAL<1.44 then PALCAT='S';
    if 1.44<=PAL<1.60 then PALCAT='LA';
    if 1.60<=PAL<1.77 then PALCAT='A';
    if 1.77<=PAL<2.5 then PALCAT='VA';
    if 2.5<=PAL then PALCAT='PAL>2.5';
  end;
  if 14.0<=age<19.0 then do;
    if .<PAL<1 then PALCAT='PAL<1';
    if 1.0<=PAL<1.57 then PALCAT='S';
    if 1.57<=PAL<1.74 then PALCAT='LA';

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        if 1.74=<PAL<1.94 then PALCAT='A';
        if 1.94=<PAL<2.5 then PALCAT='VA';
            if 2.5<=PAL then PALCAT='PAL>2.5';
    end;
    if 19.0=<age then do;
        *Note that these are based on percentiles of 19 to 70.99, but 71+ use these
too;
            if .<PAL<1 then PALCAT='PAL<1';
            if 1.0=<PAL<1.53 then PALCAT='S';
            if 1.53=<PAL<1.69 then PALCAT='LA';
            if 1.69=<PAL<1.85 then PALCAT='A';
            if 1.85=<PAL<2.5 then PALCAT='VA';
                if 2.5<=PAL then PALCAT='PAL>2.5';
    end;
run;

proc freq data=outmi2;
    tables PALCAT;
run;

* For those imputed PAL<1, truncate them to 1.0 to leave in dataset - per discussion
with WG1;
* For those imputed PAL>2.5, drop them from dataset (in that imputation) -per
discussion with WG1;
* Truncate at PAL 1 for the ones estimated at below 1;
data outmi_clean; set outmi2;
    if PAL<1 then do; PAL=1; PALCAT="S"; end;
    if PAL>2.5 then delete;
run;
* Reduced from n=172,000 to n=171,946;

proc freq data=outmi_clean;
    table _imputation_/nopercents;
run;
* Max of 8600 per imputation. Most have a couple dropped;

proc means data=outmi_clean;
    var PAL;
run;
proc freq data=outmi_clean;
    tables PALCAT;
run;

* SAVE clean MI analysis data;
data cleandf.outmi_clean;
    set outmi_clean;
run;

/* Save Final MI (unclean) dataset */
* As SAS data;

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data "&mypath.\Output\Parameter Estimates\MI_raw_&SYSDATE9..sas7bdat";
  set outmi;
run;
* As csv data;
proc export data=outmi
  outfile="&mypath.\Output\Parameter Estimates\MI_raw_&SYSDATE9..csv"
  dbms=csv REPLACE;
run;

/* SAVE clean MI dataset */
* As SAS data;
data "&mypath.\Output\Parameter Estimates\MI_clean_&SYSDATE9..sas7bdat";
  set outmi_clean;
run;
* As csv data;
proc export data=outmi_clean
  outfile="&mypath.\Output\Parameter Estimates\MI_clean_&SYSDATE9..csv"
  dbms=csv REPLACE;
run;

/*****
*****/
/*****
*****/
/***** MODELS MODELS MODELS
*****/

/* If you dont need to rerun the imputation above START HERE and import the imputed
data we saved.*/
data outmi_clean;
  set cleandf.outmi_clean;
run; *171,946;
/* *Infants, Children (Boys/Girls), Adults (Men/Women), but not Preg/Lact;*/
data allstrata;
  set cleandf.outmi_clean;
  if Strata="Preg/Lac" then delete;
run; *156,666;

/*****

/* Considering STRATA (M/F, Children/Adults/Infants) */

/* First we can check whether we need separate models for each strata - based on
interactions*/
proc glm data=outmi_clean;
  *by _imputation_;where _imputation_=20;
  class PALCAT sex Age_cat;
  model TEE = sex Age_cat
          Age PALCAT Weight Height PALCAT*Weight PALCAT*Height
          sex*Age sex*PALCAT sex*Weight sex*Height sex*PALCAT*Weight

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sex*PALCAT*Height
                Age_Cat*Age Age_Cat*PALCAT Age_Cat*Weight Age_Cat*Height
Age_Cat*PALCAT*Weight Age_Cat*PALCAT*Height /solution;
                *output out=predglm1 p=pglm1;
run;
quit;
/* This confirms that slopes for weight and height depend on sex.
   and differential slope of weight*PALCAT depends on sex
   And weight and height depends on Age_Cat;
   And weight x PALCAT depends on Age_Cat

/*SUBSET Data into Strata (M/F, Children/Adults/Infants) for models */

/*Adults - Female = Women*/
data dfF; set allstrata;
where Sex="F" & Age_cat="Adults" ;
run;

/*Adults - Male = Men*/
data dfM; set allstrata;
where Sex="M" & Age_cat="Adults" ;
run;

/*3-18 - Girls*/
data dfg; set allstrata;
where Sex="F" & 3<=Age<19 ;
run;

/*3-18 - Boys*/
data dfb; set allstrata;
where Sex="M" & 3<=Age<19 ;
run;

/*0-2 Infants - Girls*/
data dfig; set allstrata;
where Sex="F" & 0<=Age<3 ;
run;

/*0-2 Infants - Boys*/
data dfib; set allstrata;
where Sex="M" & 0<=Age<3 ;
run;

/*Pregnant - about n=430 per imputation*/
data dfp; set outmi_clean;
where Pregnant='Yes' or P_stage='NPNL';
run;

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/*Lactating - about n=200 per imputation*/
data dfl; set outmi_clean;
where Lactating='Yes' ;
run;

/** Sensitivity BMI 18.5 to 40 **/
data dff_s; set dff; where 18.5<=BMI<40; run;
data dfm_s; set dfm; where 18.5<=BMI<40; run;
data dfg_s; set dfg; where 5<=Percentile<=95; run;
data dfb_s; set dfb; where 5<=Percentile<=95; run;
data dfp_s; set dfp; where 18.5<=BMI<40; run;
data dfl_s; set dfl; where 18.5<=BMI<40; run;

/** Healthy BMI 18.5 to 25 **/
data dff_h; set dff; where 18.5<=BMI<25; run;
data dfm_h; set dfm; where 18.5<=BMI<25; run;
data dfg_h; set dfg; where 5<=Percentile<85; run;
data dfb_h; set dfb; where 5<=Percentile<85; run;
data dfp_h; set dfp; where 18.5<=BMI<25; run;
data dfl_h; set dfl; where 18.5<=BMI<25; run;

/** Overweight/Obese BMI 25+ **/
data dff_o; set dff; where 25<=BMI; run;
data dfm_o; set dfm; where 25<=BMI; run;
data dfg_o; set dfg; where 85<=Percentile; run;
data dfb_o; set dfb; where 85<=Percentile; run;
data dfp_o; set dfp; where 25<=BMI; run;
data dfl_o; set dfl; where 25<=BMI; run;

/** Include subjects for predicted values **/
data dfm; set dfm; keep SID TEE Age PALCAT Weight Height _imputation_ FM FFM; run;
proc sql;
  insert into dfm
    set SID = "MaleExtra", TEE = ., Age = 50.25, PALCAT = "A", Weight =
83.10, Height = 175.92, _imputation_=1,FM=.,FFM=.
    set SID = "MaleExtra", TEE = ., Age = 50.25, PALCAT = "A", Weight = 83.10,
Height = 175.92, _imputation_=2,FM=.,FFM=.
    set SID = "MaleExtra", TEE = ., Age = 50.25, PALCAT = "A", Weight =
83.10, Height = 175.92, _imputation_=3,FM=.,FFM=.
    set SID = "MaleExtra", TEE = ., Age = 50.25, PALCAT = "A", Weight =
83.10, Height = 175.92, _imputation_=4,FM=.,FFM=.
    set SID = "MaleExtra", TEE = ., Age = 50.25, PALCAT = "A", Weight =
83.10, Height = 175.92, _imputation_=5,FM=.,FFM=.
    set SID = "MaleExtra", TEE = ., Age = 50.25, PALCAT = "A", Weight =
83.10, Height = 175.92, _imputation_=6,FM=.,FFM=.
    set SID = "MaleExtra", TEE = ., Age = 50.25, PALCAT = "A", Weight =

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        set SID = "MaleOver", TEE = ., Age = 50.25, PALCAT = "A", Weight =
99.55, Height = 183.46, _imputation_=12,FM=.,FFM=.
        set SID = "MaleOver", TEE = ., Age = 50.25, PALCAT = "A", Weight =
99.55, Height = 183.46, _imputation_=13,FM=.,FFM=.
        set SID = "MaleOver", TEE = ., Age = 50.25, PALCAT = "A", Weight =
99.55, Height = 183.46, _imputation_=14,FM=.,FFM=.
        set SID = "MaleOver", TEE = ., Age = 50.25, PALCAT = "A", Weight =
99.55, Height = 183.46, _imputation_=15,FM=.,FFM=.
        set SID = "MaleOver", TEE = ., Age = 50.25, PALCAT = "A", Weight =
99.55, Height = 183.46, _imputation_=16,FM=.,FFM=.
        set SID = "MaleOver", TEE = ., Age = 50.25, PALCAT = "A", Weight =
99.55, Height = 183.46, _imputation_=17,FM=.,FFM=.
        set SID = "MaleOver", TEE = ., Age = 50.25, PALCAT = "A", Weight =
99.55, Height = 183.46, _imputation_=18,FM=.,FFM=.
        set SID = "MaleOver", TEE = ., Age = 50.25, PALCAT = "A", Weight =
99.55, Height = 183.46, _imputation_=19,FM=.,FFM=.
        set SID = "MaleOver", TEE = ., Age = 50.25, PALCAT = "A", Weight =
99.55, Height = 183.46, _imputation_=20,FM=.,FFM=.;
quit;

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data dff; set dff; keep SID TEE Age PALCAT Weight Height _imputation_ FM FFM; run;
*n= 71676;
proc sql;

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    insert into dff
        set SID = "FemaleExtra", TEE = ., Age = 53.87, PALCAT = "A", Weight
= 71.87, Height = 162.34, _imputation_=1,FM=.,FFM=.
        set SID = "FemaleExtra", TEE = ., Age = 53.87, PALCAT = "A", Weight
= 71.87, Height = 162.34, _imputation_=2,FM=.,FFM=.
        set SID = "FemaleExtra", TEE = ., Age = 53.87, PALCAT = "A", Weight
= 71.87, Height = 162.34, _imputation_=3,FM=.,FFM=.
        set SID = "FemaleExtra", TEE = ., Age = 53.87, PALCAT = "A", Weight
= 71.87, Height = 162.34, _imputation_=4,FM=.,FFM=.
        set SID = "FemaleExtra", TEE = ., Age = 53.87, PALCAT = "A", Weight
= 71.87, Height = 162.34, _imputation_=5,FM=.,FFM=.
        set SID = "FemaleExtra", TEE = ., Age = 53.87, PALCAT = "A", Weight
= 71.87, Height = 162.34, _imputation_=6,FM=.,FFM=.
        set SID = "FemaleExtra", TEE = ., Age = 53.87, PALCAT = "A", Weight
= 71.87, Height = 162.34, _imputation_=7,FM=.,FFM=.
        set SID = "FemaleExtra", TEE = ., Age = 53.87, PALCAT = "A", Weight
= 71.87, Height = 162.34, _imputation_=8,FM=.,FFM=.
        set SID = "FemaleExtra", TEE = ., Age = 53.87, PALCAT = "A", Weight
= 71.87, Height = 162.34, _imputation_=9,FM=.,FFM=.
        set SID = "FemaleExtra", TEE = ., Age = 53.87, PALCAT = "A", Weight
= 71.87, Height = 162.34, _imputation_=10,FM=.,FFM=.
        set SID = "FemaleExtra", TEE = ., Age = 53.87, PALCAT = "A", Weight
= 71.87, Height = 162.34, _imputation_=11,FM=.,FFM=.
        set SID = "FemaleExtra", TEE = ., Age = 53.87, PALCAT = "A", Weight
= 71.87, Height = 162.34, _imputation_=12,FM=.,FFM=.
        set SID = "FemaleExtra", TEE = ., Age = 53.87, PALCAT = "A", Weight
= 71.87, Height = 162.34, _imputation_=13,FM=.,FFM=.

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```
87.99, Height = 169.43, _imputation_=18,FM=.,FFM=.
      set SID = "FemaleOver", TEE = ., Age = 53.87, PALCAT = "A", Weight =
87.99, Height = 169.43, _imputation_=19,FM=.,FFM=.
      set SID = "FemaleOver", TEE = ., Age = 53.87, PALCAT = "A", Weight =
87.99, Height = 169.43, _imputation_=20,FM=.,FFM=.;
quit;
```

```
data dfb; set dfb; keep SID TEE Age PALCAT Weight Height _imputation_ FM FFM; run;
proc sql;
```

```
  insert into dfb
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=1,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=2,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=3,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=4,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=5,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=6,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=7,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=8,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=9,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=10,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=11,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=12,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=13,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=14,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=15,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=16,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=17,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=18,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=19,FM=.,FFM=.
    set SID = "BoyExtra", TEE = ., Age = 8.65, PALCAT = "A", Weight =
37.06, Height = 134.03, _imputation_=20,FM=.,FFM=.
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        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=1,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=2,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=3,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=4,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=5,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=6,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=7,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=8,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=9,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=10,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=11,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=12,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=13,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=14,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=15,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=16,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=17,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=18,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=19,FM=.,FFM=.
        set SID = "BoyOver", TEE = ., Age = 8.65, PALCAT = "A", Weight =
58.34, Height = 161.26, _imputation_=20,FM=.,FFM=.
;
quit;

data dfg; set dfg; keep SID TEE Age PALCAT Weight Height _imputation_ FM FFM; run;
proc sql;
    insert into dfg
        set SID = "GirlExtra", TEE = ., Age = 9.58, PALCAT = "A", Weight =
37.63, Height = 135.02, _imputation_=1,FM=.,FFM=.
        set SID = "GirlExtra", TEE = ., Age = 9.58, PALCAT = "A", Weight =

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        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=7,FM=.,FFM=.
        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=8,FM=.,FFM=.
        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=9,FM=.,FFM=.
        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=10,FM=.,FFM=.
        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=11,FM=.,FFM=.
        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=12,FM=.,FFM=.
        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=13,FM=.,FFM=.
        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=14,FM=.,FFM=.
        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=15,FM=.,FFM=.
        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=16,FM=.,FFM=.
        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=17,FM=.,FFM=.
        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=18,FM=.,FFM=.
        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=19,FM=.,FFM=.
        set SID = "Girlover", TEE = ., Age = 9.58, PALCAT = "A", Weight =
57.12, Height = 157.71, _imputation_=20,FM=.,FFM=.
;
quit;

data dfib; set dfib; keep SID TEE Age PALCAT Weight Height _imputation_ FM FFM; run;

proc sql;
    insert into dfib
        set SID = "BabyBoyExtra", TEE = ., Age = 0.69, PALCAT = "A", Weight
= 8.03, Height = 68.46, _imputation_=1,FM=.,FFM=.
        set SID = "BabyBoyExtra", TEE = ., Age = 0.69, PALCAT = "A", Weight
= 8.03, Height = 68.46, _imputation_=2,FM=.,FFM=.
        set SID = "BabyBoyExtra", TEE = ., Age = 0.69, PALCAT = "A", Weight
= 8.03, Height = 68.46, _imputation_=3,FM=.,FFM=.
        set SID = "BabyBoyExtra", TEE = ., Age = 0.69, PALCAT = "A", Weight
= 8.03, Height = 68.46, _imputation_=4,FM=.,FFM=.
        set SID = "BabyBoyExtra", TEE = ., Age = 0.69, PALCAT = "A", Weight
= 8.03, Height = 68.46, _imputation_=5,FM=.,FFM=.
        set SID = "BabyBoyExtra", TEE = ., Age = 0.69, PALCAT = "A", Weight
= 8.03, Height = 68.46, _imputation_=6,FM=.,FFM=.
        set SID = "BabyBoyExtra", TEE = ., Age = 0.69, PALCAT = "A", Weight
= 8.03, Height = 68.46, _imputation_=7,FM=.,FFM=.
        set SID = "BabyBoyExtra", TEE = ., Age = 0.69, PALCAT = "A", Weight

```



```

        set SID = "BabyBoyOver", TEE = ., Age = 0.69, PALCAT = "A", Weight =
10.76, Height = 79.06, _imputation_=13,FM=.,FFM=.
        set SID = "BabyBoyOver", TEE = ., Age = 0.69, PALCAT = "A", Weight =
10.76, Height = 79.06, _imputation_=14,FM=.,FFM=.
        set SID = "BabyBoyOver", TEE = ., Age = 0.69, PALCAT = "A", Weight =
10.76, Height = 79.06, _imputation_=15,FM=.,FFM=.
        set SID = "BabyBoyOver", TEE = ., Age = 0.69, PALCAT = "A", Weight =
10.76, Height = 79.06, _imputation_=16,FM=.,FFM=.
        set SID = "BabyBoyOver", TEE = ., Age = 0.69, PALCAT = "A", Weight =
10.76, Height = 79.06, _imputation_=17,FM=.,FFM=.
        set SID = "BabyBoyOver", TEE = ., Age = 0.69, PALCAT = "A", Weight =
10.76, Height = 79.06, _imputation_=18,FM=.,FFM=.
        set SID = "BabyBoyOver", TEE = ., Age = 0.69, PALCAT = "A", Weight =
10.76, Height = 79.06, _imputation_=19,FM=.,FFM=.
        set SID = "BabyBoyOver", TEE = ., Age = 0.69, PALCAT = "A", Weight =
10.76, Height = 79.06, _imputation_=20,FM=.,FFM=.;
quit;

```

```

data dfig; set dfig; keep SID TEE Age PALCAT Weight Height _imputation_ FM FFM; run;

```

```

proc sql;

```

```

    insert into dfig
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=1,FM=.,FFM=.
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=2,FM=.,FFM=.
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=3,FM=.,FFM=.
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=4,FM=.,FFM=.
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=5,FM=.,FFM=.
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=6,FM=.,FFM=.
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=7,FM=.,FFM=.
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=8,FM=.,FFM=.
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=9,FM=.,FFM=.
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=10,FM=.,FFM=.
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=11,FM=.,FFM=.
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=12,FM=.,FFM=.
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=13,FM=.,FFM=.
        set SID = "BabyGirlExtra", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 7.81, Height = 68.31, _imputation_=14,FM=.,FFM=.

```



```
= 10.36, Height = 78.81, _imputation_=19,FM=.,FFM=.
      set SID = "BabyGirlOver", TEE = ., Age = 0.72, PALCAT = "A", Weight
= 10.36, Height = 78.81, _imputation_=20,FM=.,FFM=.;
quit;
```

```
data dfp; set dfp; keep SID TEE Age PALCAT Weight Height Weeks _imputation_; run;
proc sql;
```

```
  insert into dfp
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=1
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=2
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=3
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=4
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=5
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=6
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=7
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=8
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=9
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=10
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=11
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=12
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=13
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=14
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=15
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=16
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=17
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=18
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=19
    set SID = "PregnantExtra", TEE = ., Age = 29.40, PALCAT = "A",
Weight = 74.89, Height = 164.13, Weeks=19.86, _imputation_=20

    set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
```

```
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=1
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=2
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=3
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=4
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=5
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=6
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=7
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=8
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=9
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=10
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=11
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=12
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=13
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=14
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=15
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=16
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=17
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=18
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=19
  set SID = "PregnantOver", TEE = ., Age = 29.40, PALCAT = "A", Weight
= 95.07, Height = 170.72, Weeks=19.86, _imputation_=20;
```

quit;

```
/*****
*****/
/*****
*****/
/***** LINEAR REGRESSION
*****/
```

```

%macro glmint(agecat, cat);
/** linear regression with interaction */
proc sort data=df&agecat.; by _imputation_; run;
proc glm data=df&agecat.;
  by _imputation_; *where _imputation_=20;
  class PALCAT;
  model TEE = Age PALCAT Weight Height PALCAT*Weight PALCAT*Height /solution;
  *output out=predglm p=pglm;

  estimate 'Sedentary: Intercept' Intercept 1 PALCAT 0 0 1 0 ;
  estimate 'Sedentary: Age' Age 1;
  estimate 'Sedentary: Weight' Weight 1 PALCAT*Weight 0 0 1 0;
  estimate 'Sedentary: Height' Height 1 PALCAT*Height 0 0 1 0;

  estimate 'Low Active: Intercept' Intercept 1 PALCAT 0 1 0 0 ;
  estimate 'Low Active: Age' Age 1;
  estimate 'Low Active: Weight' Weight 1 PALCAT*Weight 0 1 0 0 ;
  estimate 'Low Active: Height' Height 1 PALCAT*Height 0 1 0 0 ;

  estimate 'Active: Intercept' Intercept 1 PALCAT 1 0 0 0 ;
  estimate 'Active: Age' Age 1;
  estimate 'Active: Weight' Weight 1 PALCAT*Weight 1 0 0 0 ;
  estimate 'Active: Height' Height 1 PALCAT*Height 1 0 0 0 ;

  estimate 'Very Active: Intercept' Intercept 1 PALCAT 0 0 0 1 ;
  estimate 'Very Active: Age' Age 1;
  estimate 'Very Active: Weight' Weight 1 PALCAT*Weight 0 0 0 1 ;
  estimate 'Very Active: Height' Height 1 PALCAT*Height 0 0 0 1 ;

  ods output Estimates=Est_&agecat. ParameterEstimates=Par_&agecat.;
  output out=newdf&agecat. p=predicted UCL=UCL LCL=LCL STDI=STDI;
run;
quit;
/** Pooled results */
proc sort data=Est_&agecat.; by Parameter;run;
proc mianalyze data=Est_&agecat.;
  by Parameter;
  modeleffects Estimate ;
  stderr StdErr;
  ods output ParameterEstimates=Pooled_&agecat.;
run;
proc sort data=Par_&agecat.; by Parameter;run;
proc mianalyze data=Par_&agecat.;
  by Parameter;
  modeleffects Estimate ;
  stderr StdErr;
  ods output ParameterEstimates=ParmPooled_&agecat.;
run;
/** Pooled predcited results */

```

```

proc sort data=newdf&agecat.; by SID;run;
proc mianalyze data=newdf&agecat.;
    by SID;
    modeleffects predicted ;
    stderr STDI;
    ods output ParameterEstimates=S_&agecat.;
run;
/** Identify datasets to merge **/
data Est_&agecat.; set Est_&agecat.; length Category $25; Category=&cat.; run;
data Pooled_&agecat.; set Pooled_&agecat.; length Category $25; Category=&cat.; run;
data ParmPooled_&agecat.; set ParmPooled_&agecat.; length Category $25;
Category=&cat.; run;
%mend;

%glmint(F, 'Females'); *Adult Women;
%glmint(M, 'Males'); *Adult Men;
%glmint(g, 'Girls');
%glmint(b, 'Boys');

%glmint(F_s, 'Females 18.5-40');
%glmint(M_s, 'Males 18.5-40');
%glmint(g_s, 'Girls 5-95');
%glmint(b_s, 'Boys 5-95');

%glmint(F_h, 'Females 18.5-25');
%glmint(M_h, 'Males 18.5-25');
%glmint(g_h, 'Girls 5-85');
%glmint(b_h, 'Boys 5-85');

%glmint(F_o, 'Females 25+');
%glmint(M_o, 'Males 25+');
%glmint(g_o, 'Girls 85+');
%glmint(b_o, 'Boys 85+');

/*****Include FFFM *****/
%macro glmffm(agecat, cat);
/** linear regression with interaction **/
proc glm data=df&agecat.;
    by _imputation_ *where _imputation_=20;
    class PALCAT;
    model TEE = Age PALCAT FM FFM Height PALCAT*FM PALCAT*FFM PALCAT*Height
/solution;
    *output out=predglm p=pglm;

    estimate 'Sedentary: Intercept' Intercept 1 PALCAT 0 0 1 0 ;
    estimate 'Sedentary: Age' Age 1;
    estimate 'Sedentary: FM' FM 1 PALCAT*FM 0 0 1 0;
    estimate 'Sedentary: FFM' FFM 1 PALCAT*FFM 0 0 1 0;
    estimate 'Sedentary: Height' Height 1 PALCAT*Height 0 0 1 0;

```

```

estimate 'Low Active: Intercept' Intercept 1 PALCAT 0 1 0 0 ;
estimate 'Low Active: Age' Age 1;
estimate 'Low Active: FM' FM 1 PALCAT*FM 0 1 0 0 ;
estimate 'Low Active: FFM' FFM 1 PALCAT*FFM 0 1 0 0 ;
estimate 'Low Active: Height' Height 1 PALCAT*Height 0 1 0 0 ;

estimate 'Active: Intercept' Intercept 1 PALCAT 1 0 0 0 ;
estimate 'Active: Age' Age 1;
estimate 'Active: FM' FM 1 PALCAT*FM 1 0 0 0 ;
estimate 'Active: FFM' FFM 1 PALCAT*FFM 1 0 0 0 ;
estimate 'Active: Height' Height 1 PALCAT*Height 1 0 0 0 ;

estimate 'Very Active: Intercept' Intercept 1 PALCAT 0 0 0 1 ;
estimate 'Very Active: Age' Age 1;
estimate 'Very Active: FM' FM 1 PALCAT*FM 0 0 0 1 ;
estimate 'Very Active: FFM' FFM 1 PALCAT*FFM 0 0 0 1 ;
estimate 'Very Active: Height' Height 1 PALCAT*Height 0 0 0 1 ;

ods output Estimates=Est_&agecat._FFM ParameterEstimates=Par_&agecat._FFM;
*output out=newdf&agecat. p=predicted UCL=UCL LCL=LCL STDI=STDI;
run;
quit;
/** Pooled results **/
proc sort data=Est_&agecat._FFM; by Parameter;run;
proc mianalyze data=Est_&agecat._FFM;
    by Parameter;
    modeleffects Estimate ;
    stderr StdErr;
    ods output ParameterEstimates=Pooled_&agecat._FFM;
run;
proc sort data=Par_&agecat._FFM; by Parameter;run;
proc mianalyze data=Par_&agecat._FFM;
    by Parameter;
    modeleffects Estimate ;
    stderr StdErr;
    ods output ParameterEstimates=ParmPooled_&agecat._FFM;
run;
/** Identify datasets to merge **/
data Est_&agecat._FFM; set Est_&agecat._FFM; length Category $25; Category=&cat.;
run;
data Pooled_&agecat._FFM; set Pooled_&agecat._FFM; length Category $25;
Category=&cat.; run;
data ParmPooled_&agecat._FFM; set ParmPooled_&agecat._FFM; length Category $25;
Category=&cat.; run;
%mend;

%glmffm(F, 'Females FFM'); *Adult Women;
%glmffm(M, 'Males FFM'); *Adult Men;
%glmffm(g, 'Girls FFM');
%glmffm(b, 'Boys FFM');

```

```

/***** Infants *****/
%macro inf_glmint(sex,mod,cov, cat);
/** linear regression with interaction **/
proc sort data=dfi&sex.; by _imputation_; run;
proc glm data=dfi&sex.;
    by _imputation_; *where _imputation_=20;
    model TEE = &cov. /solution;
    ods output ParameterEstimates=Est_i;
    output out=newdf&mod. p=predicted UCL=UCL LCL=LCL STDI=STDI;
run;
quit;
/** Pooled results **/
proc sort data=Est_i; by Parameter;run;
proc mianalyze data=Est_i;
    by Parameter;
    modeleffects Estimate ;
    stderr StdErr;
    ods output ParameterEstimates=Pooled_&mod.;
run;
/** Pooled predicted results **/
proc sort data=newdf&mod.; by SID;run;
proc mianalyze data=newdf&mod.;
    by SID;
    modeleffects predicted ;
    stderr STDI;
    ods output ParameterEstimates=S_&mod.;
run;
/** Identify datasets to merge **/
data Est_i; set Est_i; length Category $25; Category=&cat.; run;
data Pooled_&mod.; set Pooled_&mod.; length Category $25; Category=&cat.; run;
%mend;

%inf_glmint(g,igW,Weight, 'Inf Girls Weight only');
%inf_glmint(b,ibW,Weight, 'Inf Boys Weight only');

%inf_glmint(g,igAWH,Age Weight Height , 'Inf Girls Age Wt Ht');
%inf_glmint(b,ibAWH,Age Weight Height , 'Inf Boys Age Wt Ht');

%inf_glmint(g,igFFM,Age FM FFM Height , 'Inf Girls Age FM Ht');
%inf_glmint(b,ibFFM,Age FM FFM Height , 'Inf Boys Age FM Ht');

/***** Pregnant *****/
%macro pglmint(agecat, cat);
/** linear mixed models with interaction **/
proc sort data=df&agecat.; by _imputation_; run;

```

```

proc mixed data=df&agecat.;
  by _imputation_ *where _imputation_=19;
  class PALCAT SID;
  model TEE = Age Weeks PALCAT Weight Height PALCAT*Weight PALCAT*Height
/solution outp=newdf&agecat.;
  *output out=predglm p=pglm;

  estimate 'Sedentary: Intercept' Intercept 1 PALCAT 0 0 1 0 ;
  estimate 'Sedentary: Age' Age 1;
  estimate 'Sedentary: Weight' Weight 1 PALCAT*Weight 0 0 1 0;
  estimate 'Sedentary: Height' Height 1 PALCAT*Height 0 0 1 0;
  estimate 'Sedentary: Weeks Preg' Weeks 1;

  estimate 'Low Active: Intercept' Intercept 1 PALCAT 0 1 0 0 ;
  estimate 'Low Active: Age' Age 1;
  estimate 'Low Active: Weight' Weight 1 PALCAT*Weight 0 1 0 0 ;
  estimate 'Low Active: Height' Height 1 PALCAT*Height 0 1 0 0 ;
  estimate 'Low Active: Weeks Preg' Weeks 1;

  estimate 'Active: Intercept' Intercept 1 PALCAT 1 0 0 0 ;
  estimate 'Active: Age' Age 1;
  estimate 'Active: Weight' Weight 1 PALCAT*Weight 1 0 0 0 ;
  estimate 'Active: Height' Height 1 PALCAT*Height 1 0 0 0 ;
  estimate 'Active: Weeks Preg' Weeks 1;

  estimate 'Very Active: Intercept' Intercept 1 PALCAT 0 0 0 1 ;
  estimate 'Very Active: Age' Age 1;
  estimate 'Very Active: Weight' Weight 1 PALCAT*Weight 0 0 0 1 ;
  estimate 'Very Active: Height' Height 1 PALCAT*Height 0 0 0 1 ;
  estimate 'Very Active: Weeks Preg' Weeks 1;

  ods output Estimates=Est_&agecat. SolutionF=Par_&agecat.;
repeated / SUBJECT = SID ;
run;
quit;
/** Pooled results **/
proc sort data=Est_&agecat.; by Label;run;
proc mianalyze data=Est_&agecat.;
  by Label;
  modeleffects Estimate ;
  stderr StdErr;
  ods output ParameterEstimates=Pooled_&agecat.;
run;
data Par_&agecat.; Set Par_&agecat.; Parameter=catx(' ',Effect,PALCAT);run;
proc sort data=Par_&agecat.; by Parameter;run;
proc mianalyze data=Par_&agecat.;
  by Parameter;
  modeleffects Estimate ;
  stderr StdErr;
  ods output ParameterEstimates=ParmPooled_&agecat.;

```



```

run;
/** Pooled predicted results **/
data newdf&agecat.; set newdf&agecat.; /*Rename variables for dfp*/
rename Pred=predicted
      StdErrPred=STDI
      Lower=LCL
      Upper=UCL;
run;
proc sort data=newdf&agecat.; by SID;run;
proc mianalyze data=newdf&agecat.;
      by SID;
      modeleffects predicted ;
      stderr STDI;
      ods output ParameterEstimates=S_&agecat.;
run;
/** Identify datasets to merge **/
data Est_&agecat.; set Est_&agecat.; length Category $25; Category=&cat.; run;
data Pooled_&agecat.; set Pooled_&agecat.; length Category $25; Category=&cat.; run;
data Pooled_&agecat.; set Pooled_&agecat.; rename Label = Parameter; run;
data ParmPooled_&agecat.; set ParmPooled_&agecat.; length Category $25;
Category=&cat.; run;
%mend;

%pglmint(p, 'Pregnant');
%pglmint(p_s, 'Pregnant 18.5-40');
%pglmint(p_h, 'Pregnant 18.5-25');
%pglmint(p_o, 'Pregnant 25+');

/***** Merge datasets together *****/

data Pooled_results; set Pooled_F Pooled_M Pooled_p Pooled_g Pooled_b
                        Pooled_F_s Pooled_M_s Pooled_p_s
Pooled_g_s Pooled_b_s
                        Pooled_F_h Pooled_M_h Pooled_p_h
Pooled_g_h Pooled_b_h
                        Pooled_F_o Pooled_M_o Pooled_p_o
Pooled_g_o Pooled_b_o
                        Pooled_F_ffm Pooled_M_ffm
Pooled_g_ffm Pooled_b_ffm
                        Pooled_igw Pooled_igawh
Pooled_igffm
                        Pooled_ibw Pooled_ibawh
Pooled_ibffm; run;

data ParmPooled_results; set ParmPooled_F ParmPooled_M ParmPooled_p ParmPooled_g
ParmPooled_b
                        ParmPooled_F_s ParmPooled_M_s
ParmPooled_p_s ParmPooled_g_s ParmPooled_b_s

```

```

ParmPooled_p_h ParmPooled_g_h ParmPooled_b_h
ParmPooled_p_o ParmPooled_g_o ParmPooled_b_o
ParmPooled_g_ffm ParmPooled_b_ffm; run;

ParmPooled_F_h ParmPooled_M_h
ParmPooled_F_o ParmPooled_M_o
ParmPooled_F_ffm ParmPooled_M_ffm

/* SAVE Parameters */

/*Save estimates linear regression with interaction*/
* As SAS data;
data "&mypath.\Output\Parameter Estimates\MI_glm_pooled_&SYSDATE9..sas7bdat";
  set Pooled_results;
run;

* As csv data;
proc export data=Pooled_results
  outfile="&mypath.\Output\Parameter Estimates\MI_glm_pooled_&SYSDATE9..csv"
  dbms=csv REPLACE;
run;

/*Save parameters linear regression with interaction*/
* As SAS data;
data "&mypath.\Output\Parameter Estimates\MI_glm_parm_pooled_&SYSDATE9..sas7bdat";
  set ParmPooled_results;
run;

* As csv data;
proc export data=ParmPooled_results
  outfile="&mypath.\Output\Parameter Estimates\MI_glm_parm_pooled_&SYSDATE9..csv"
  dbms=csv REPLACE;
run;

/*****
/***** Merge predicted datasets together *****/

data df_new; set S_F (where=(SID='FemaleExtra' OR SID='FemaleOver'))
              S_M (where=(SID='MaleExtra' OR SID='MaleOver'))
              S_g (where=(SID='GirlExtra' OR SID='GirlOver'))
              S_b (where=(SID='BoyExtra' OR SID='BoyOver'))
              S_igAWH (where=(SID='BabyGirlExtra' OR
SID='BabyGirlOver'))
              S_ibAWH (where=(SID='BabyBoyExtra' OR
SID='BabyBoyOver'))
              S_p (where=(SID='PregnantExtra' OR
SID='PregnantOver')) ; run;

```

```

/* SAVE dataset */

/*Save new data from predicted values*/
* As SAS data;
data "&mypath.\Output\Parameter Estimates\MI_predicted_&SYSDATE9..sas7bdat";
  set df_new;
run;

* As csv data;
proc export data=df_new
  outfile="&mypath.\Output\Parameter Estimates\MI_predicted_&SYSDATE9..csv"
  dbms=csv REPLACE;
run;

/*****
*****/
/***** COMPARE SLOPES BTWN HEALTHY vs OVER/OBESE *****/
*****/
/*****
*****/

* To do this we have to fit new models including both Healthy and Overweight/Obese
and test the interactions between them;
* Stephanie is adding this code 8/25/2022 ;

data outmi_clean; set cleandf.outmi_clean; run;

data allstrata;
  set outmi_clean;
  if 18.5<BMI;
  if Strata="Preg/Lac" then delete;
  if .<BMI<25 then BMIgrp='Healthy <25';
  if BMI>=25 then BMIgrp='Over 25 ';
run;
/*Adults - Female = Women*/
data dfF; set allstrata;
where Sex="F" & Age_cat="Adults" ;
run;
/*Adults - Male = Men*/
data dfM; set allstrata;
where Sex="M" & Age_cat="Adults" ;
run;
/*3-18 - Girls*/
data dfg; set allstrata;
where Sex="F" & 3<=Age<19 ;
run;
/*3-18 - Boys*/

```

```

data dfb; set allstrata;
where Sex="M" & 3<=Age<19 ;
run;
/*Pregnant - about n=430 per imputation*/
data dfp; set outmi_clean;
where Pregnant='Yes' or P_stage='NPNL';
    if 18.5<BMI<25 then BMIgrp='Healthy <25';
    if BMI>=25 then BMIgrp='Over 25 ';
run;

/* Just for stepping through code: %let agecat=F; %let cat='Females'; */
%macro glmint(agecat, cat);
/** linear regression with interaction */
proc sort data=df&agecat.; by _imputation_; run;
proc glm data=df&agecat.;
    by _imputation_; *where _imputation_=1;
    class PALCAT BMIgrp;
    model TEE = Age PALCAT Weight Height PALCAT*Weight PALCAT*Height
        BMIgrp
        Age*BMIgrp PALCAT*BMIgrp
        Weight*BMIgrp Height*BMIgrp
        PALCAT*Weight*BMIgrp PALCAT*Height*BMIgrp /solution;
    *output out=predglm p=pglm;

    *estimate 'Age U v O' Age*BMIgrp 1 -1;
    *estimate 'Sedentary: Int for H ' Intercept 1 PALCAT 0 0 1 0 BMIgrp 1 0
PALCAT*BMIgrp 0 0 0 0 1 0 0 0;
    *estimate 'Sedentary: Int for Ov' Intercept 1 PALCAT 0 0 1 0 BMIgrp 0 1
PALCAT*BMIgrp 0 0 0 0 0 1 0 0;
    *estimate 'Sedentary: Age for H ' Age 1 ;

    estimate 'Sedentary: Wt slope for H' Weight 1 PALCAT*Weight 0 0 1 0
Weight*BMIgrp 1 0 PALCAT*Weight*BMIgrp 0 0 0 0 1 0 0 0;
    estimate 'Sedentary: Wt slope for O' Weight 1 PALCAT*Weight 0 0 1 0
Weight*BMIgrp 0 1 PALCAT*Weight*BMIgrp 0 0 0 0 0 1 0 0;
    estimate 'Sedentary: Ht slope for H' Height 1 PALCAT*Height 0 0 1 0
Height*BMIgrp 1 0 PALCAT*Height*BMIgrp 0 0 0 0 1 0 0 0;
    estimate 'Sedentary: Ht slope for O' Height 1 PALCAT*Height 0 0 1 0
Height*BMIgrp 0 1 PALCAT*Height*BMIgrp 0 0 0 0 0 1 0 0;

    estimate ' _S: Weight H vs O' Weight*BMIgrp 1 -1 PALCAT*Weight*BMIgrp 0 0 0
0 1 -1 0 0;
    estimate ' _S: Height H vs O' Height*BMIgrp 1 -1 PALCAT*Height*BMIgrp 0 0 0
0 1 -1 0 0;

    estimate 'Low Active: Wt slope for H' Weight 1 PALCAT*Weight 0 1 0 0
Weight*BMIgrp 1 0 PALCAT*Weight*BMIgrp 0 0 1 0 0 0 0 0;
    estimate 'Low Active: Wt slope for O' Weight 1 PALCAT*Weight 0 1 0 0
Weight*BMIgrp 0 1 PALCAT*Weight*BMIgrp 0 0 0 1 0 0 0 0;
    estimate 'Low Active: Ht slope for H' Height 1 PALCAT*Height 0 1 0 0

```

```

Height*BMIgrp 1 0 PALCAT*Height*BMIgrp 0 0 1 0 0 0 0 0;
    estimate 'Low Active: Ht slope for 0' Height 1 PALCAT*Height 0 1 0 0
Height*BMIgrp 0 1 PALCAT*Height*BMIgrp 0 0 0 1 0 0 0 0;

    estimate '_LA: Weight H vs 0' Weight*BMIgrp 1 -1 PALCAT*Weight*BMIgrp 0 0
1 -1 0 0 0 0;
    estimate '_LA: Height H vs 0' Height*BMIgrp 1 -1 PALCAT*Height*BMIgrp 0 0
1 -1 0 0 0 0;

    estimate 'Active: Wt slope for H' Weight 1 PALCAT*Weight 1 0 0 0
Weight*BMIgrp 1 0 PALCAT*Weight*BMIgrp 1 0 0 0 0 0 0 0;
    estimate 'Active: Wt slope for 0' Weight 1 PALCAT*Weight 1 0 0 0
Weight*BMIgrp 0 1 PALCAT*Weight*BMIgrp 0 1 0 0 0 0 0 0;
    estimate 'Active: Ht slope for H' Height 1 PALCAT*Height 1 0 0 0
Height*BMIgrp 1 0 PALCAT*Height*BMIgrp 1 0 0 0 0 0 0 0;
    estimate 'Active: Ht slope for 0' Height 1 PALCAT*Height 1 0 0 0
Height*BMIgrp 0 1 PALCAT*Height*BMIgrp 0 1 0 0 0 0 0 0;

    estimate '_A: Weight H vs 0' Weight*BMIgrp 1 -1 PALCAT*Weight*BMIgrp 1 -1
0 0 0 0 0 0;
    estimate '_A: Height H vs 0' Height*BMIgrp 1 -1 PALCAT*Height*BMIgrp 1 -1
0 0 0 0 0 0;

    estimate 'Very Active: Wt slope for H' Weight 1 PALCAT*Weight 0 0 0 1
Weight*BMIgrp 1 0 PALCAT*Weight*BMIgrp 0 0 0 0 0 0 1 0;
    estimate 'Very Active: Wt slope for 0' Weight 1 PALCAT*Weight 0 0 0 1
Weight*BMIgrp 0 1 PALCAT*Weight*BMIgrp 0 0 0 0 0 0 0 1;
    estimate 'Very Active: Ht slope for H' Height 1 PALCAT*Height 0 0 0 1
Height*BMIgrp 1 0 PALCAT*Height*BMIgrp 0 0 0 0 0 0 1 0;
    estimate 'Very Active: Ht slope for 0' Height 1 PALCAT*Height 0 0 0 1
Height*BMIgrp 0 1 PALCAT*Height*BMIgrp 0 0 0 0 0 0 0 1;

    estimate '_VA: Weight H vs 0' Weight*BMIgrp 1 -1 PALCAT*Weight*BMIgrp 0 0 0
0 0 0 1 -1;
    estimate '_VA: Height H vs 0' Height*BMIgrp 1 -1 PALCAT*Height*BMIgrp 0 0 0
0 0 0 1 -1;

ods output parameterEstimates=PEst_&agecat. Estimates=Est_&agecat.;
run;
quit;
/** Pooled results **/
proc sort data=PEst_&agecat.; by Parameter;run;
proc mianalyze data=PEst_&agecat.(where=(not missing(stderr)));
    by Parameter;
    modeleffects Estimate ;
    stderr StdErr;
    ods output ParameterEstimates=Pooled_PEst&agecat.;
run;
proc sort data=Est_&agecat.; by Parameter;run;
proc mianalyze data=Est_&agecat.(where=(not missing(stderr)));

```

```

        by Parameter;
    modeleffects Estimate ;
        stderr StdErr;
        ods output ParameterEstimates=Pooled_Est&agecat.;
run;
/** Identify datasets to merge */
data PEst_&agecat.; length Category $12; set PEst_&agecat.; Category=&cat.; run;
data Est_&agecat.; length Category $12; set Est_&agecat.; Category=&cat.; run;
data Pooled_PEst&agecat.; length Category $12; set Pooled_PEst&agecat.;
Category=&cat.; run;
data Pooled_Est&agecat.; length Category $12; set Pooled_Est&agecat.;
Category=&cat.; run;
%mend;

%glmint(F, 'Females'); *Adult Women;
%glmint(M, 'Males'); *Adult Men;
%glmint(g, 'Girls');
%glmint(b, 'Boys');

/** Pregnant */
/* Just for stepping through code: %let agecat=p; %let cat='Pregnant'; */
%macro glmintp(agecat, cat);
/** linear regression with interaction */
proc sort data=df&agecat.; by _imputation_; run;
proc mixed data=df&agecat.;
    by _imputation_; *where _imputation_=1;
    class PALCAT BMIgrp SID;
    model TEE = Age PALCAT Weight Height PALCAT*Weight PALCAT*Height
        BMIgrp Weeks Weeks*BMIgrp
        Age*BMIgrp PALCAT*BMIgrp
        Weight*BMIgrp Height*BMIgrp
        PALCAT*Weight*BMIgrp PALCAT*Height*BMIgrp /solution;
    *output out=predglm p=pglm;

    *estimate 'Age U v 0' Age*BMIgrp 1 -1;
    *estimate 'Sedentary: Int for H ' Intercept 1 PALCAT 0 0 1 0 BMIgrp 1 0
PALCAT*BMIgrp 0 0 0 0 1 0 0 0;
    *estimate 'Sedentary: Int for Ov' Intercept 1 PALCAT 0 0 1 0 BMIgrp 0 1
PALCAT*BMIgrp 0 0 0 0 0 1 0 0;
    *estimate 'Sedentary: Age for H ' Age 1 ;

    estimate 'Sedentary: Wt slope for H' Weight 1 PALCAT*Weight 0 0 1 0
Weight*BMIgrp 1 0 PALCAT*Weight*BMIgrp 0 0 0 0 1 0 0 0;
    estimate 'Sedentary: Wt slope for O' Weight 1 PALCAT*Weight 0 0 1 0
Weight*BMIgrp 0 1 PALCAT*Weight*BMIgrp 0 0 0 0 0 1 0 0;
    estimate 'Sedentary: Ht slope for H' Height 1 PALCAT*Height 0 0 1 0
Height*BMIgrp 1 0 PALCAT*Height*BMIgrp 0 0 0 0 1 0 0 0;
    estimate 'Sedentary: Ht slope for O' Height 1 PALCAT*Height 0 0 1 0
Height*BMIgrp 0 1 PALCAT*Height*BMIgrp 0 0 0 0 0 1 0 0;

```

```

estimate ' _S: Weight H vs 0' Weight*BMIgrp 1 -1 PALCAT*Weight*BMIgrp 0 0 0
0 1 -1 0 0;
estimate ' _S: Height H vs 0' Height*BMIgrp 1 -1 PALCAT*Height*BMIgrp 0 0 0
0 1 -1 0 0;

estimate 'Low Active: Wt slope for H' Weight 1 PALCAT*Weight 0 1 0 0
Weight*BMIgrp 1 0 PALCAT*Weight*BMIgrp 0 0 1 0 0 0 0 0;
estimate 'Low Active: Wt slope for 0' Weight 1 PALCAT*Weight 0 1 0 0
Weight*BMIgrp 0 1 PALCAT*Weight*BMIgrp 0 0 0 1 0 0 0 0;
estimate 'Low Active: Ht slope for H' Height 1 PALCAT*Height 0 1 0 0
Height*BMIgrp 1 0 PALCAT*Height*BMIgrp 0 0 1 0 0 0 0 0;
estimate 'Low Active: Ht slope for 0' Height 1 PALCAT*Height 0 1 0 0
Height*BMIgrp 0 1 PALCAT*Height*BMIgrp 0 0 0 1 0 0 0 0;

estimate ' _LA: Weight H vs 0' Weight*BMIgrp 1 -1 PALCAT*Weight*BMIgrp 0 0
1 -1 0 0 0 0;
estimate ' _LA: Height H vs 0' Height*BMIgrp 1 -1 PALCAT*Height*BMIgrp 0 0
1 -1 0 0 0 0;

estimate 'Active: Wt slope for H' Weight 1 PALCAT*Weight 1 0 0 0
Weight*BMIgrp 1 0 PALCAT*Weight*BMIgrp 1 0 0 0 0 0 0 0;
estimate 'Active: Wt slope for 0' Weight 1 PALCAT*Weight 1 0 0 0
Weight*BMIgrp 0 1 PALCAT*Weight*BMIgrp 0 1 0 0 0 0 0 0;
estimate 'Active: Ht slope for H' Height 1 PALCAT*Height 1 0 0 0
Height*BMIgrp 1 0 PALCAT*Height*BMIgrp 1 0 0 0 0 0 0 0;
estimate 'Active: Ht slope for 0' Height 1 PALCAT*Height 1 0 0 0
Height*BMIgrp 0 1 PALCAT*Height*BMIgrp 0 1 0 0 0 0 0 0;

estimate ' _A: Weight H vs 0' Weight*BMIgrp 1 -1 PALCAT*Weight*BMIgrp 1 -1
0 0 0 0 0 0;
estimate ' _A: Height H vs 0' Height*BMIgrp 1 -1 PALCAT*Height*BMIgrp 1 -1
0 0 0 0 0 0;

estimate 'Very Active: Wt slope for H' Weight 1 PALCAT*Weight 0 0 0 1
Weight*BMIgrp 1 0 PALCAT*Weight*BMIgrp 0 0 0 0 0 0 1 0;
estimate 'Very Active: Wt slope for 0' Weight 1 PALCAT*Weight 0 0 0 1
Weight*BMIgrp 0 1 PALCAT*Weight*BMIgrp 0 0 0 0 0 0 0 1;
estimate 'Very Active: Ht slope for H' Height 1 PALCAT*Height 0 0 0 1
Height*BMIgrp 1 0 PALCAT*Height*BMIgrp 0 0 0 0 0 0 1 0;
estimate 'Very Active: Ht slope for 0' Height 1 PALCAT*Height 0 0 0 1
Height*BMIgrp 0 1 PALCAT*Height*BMIgrp 0 0 0 0 0 0 0 1;

estimate ' _VA: Weight H vs 0' Weight*BMIgrp 1 -1 PALCAT*Weight*BMIgrp 0 0 0
0 0 0 1 -1;
estimate ' _VA: Height H vs 0' Height*BMIgrp 1 -1 PALCAT*Height*BMIgrp 0 0 0
0 0 0 1 -1;

```

```

ods output SolutionF=PEst_&agecat. Estimates=Est_&agecat.;
repeated / SUBJECT = SID ;

```

```

run;
quit;
/** Pooled results **/
data PEst_&agecat.; Set PEst_&agecat.; Parameter=catx(' ',Effect,PALCAT,BMIgrp);run;
data Est_&agecat.; Set Est_&agecat.; Parameter=Label;run;
proc sort data=PEst_&agecat.; by Parameter;run;
proc mianalyze data=PEst_&agecat.(where=(not missing(stderr)));
    by Parameter;
    modeleffects Estimate ;
    stderr StdErr;
    ods output ParameterEstimates=Pooled_PEst&agecat.;
run;
proc sort data=Est_&agecat.; by Parameter;run;
proc mianalyze data=Est_&agecat.(where=(not missing(stderr)));
    by Parameter;
    modeleffects Estimate ;
    stderr StdErr;
    ods output ParameterEstimates=Pooled_Est&agecat.;
run;
/** Identify datasets to merge **/
data PEst_&agecat.; length Category $12; set PEst_&agecat.; Category=&cat.; run;
data Est_&agecat.; length Category $12; set Est_&agecat.; Category=&cat.; run;
data Pooled_PEst&agecat.; length Category $12; set Pooled_PEst&agecat.;
Category=&cat.; run;
data Pooled_Est&agecat.; length Category $12; set Pooled_Est&agecat.;
Category=&cat.; run;
%mend;

%glmintp(p, 'Pregnant'); *Adult Women;

data Pooled_Estimates;
set Pooled_EstF Pooled_EstM Pooled_Estg Pooled_Estb Pooled_Estp;
run;
proc sort data=Pooled_estimates;
    by Parameter Category;
run;

/*Save estimates comparing Healthy vs Overweight/Obese*/
* As SAS data;
data "&mypath.\Output\Parameter Estimates\MI_glm_pooled_comps_&SYSDATE9..sas7bdat";
    set Pooled_Estimates;
run;

* As csv data;
proc export data=Pooled_Estimates

```



```
outfile="&mypath.\Output\Parameter Estimates\MI_glm_pooled_comps_&SYSDATE9..csv"  
dbms=csv REPLACE;  
run;
```