Supplementary Materials

S.1.1 A plot of the ASD before and after inverse probability of treatment weighting can be generated using the ASD plot macro created by Jing You, formally at Cleveland Clinic. The macro code is available as supplementary material for the manuscript as it is not currently posted.

S.1.2 To run the ASD macro, a data file is created with the covariate names, the ASD before weighting, and the ASD after weighting. Calling the macro after running the data statement then generates the plot.

ASD plot macro

```
/*-------------------------------------------------------------------------------*
| MACRO NAME  : ASDplot
| SHORT DESC  : Create high-quality plot of Absolute Standardized Difference
|                                 before and after matching
*-------------------------------------------------------------------------------*
| CREATED BY  : You, Jing                                                (11/07/2014)
*-------------------------------------------------------------------------------*
| PURPOSE
|
| This macro plots Absolute Standardized Difference before and after matching:
| 1) Show improvement of balance on covariables after matching.
| 2) Show criterion of imbalance.
*-------------------------------------------------------------------------------*
| MACRO CALL
|
| % ASDPlot(gpath = ,
|                          ASD_descending = 1,
|                          cutoff = 0.20,
|                          image_blackwhite = 0,
|                          image_name   = ASD_plot,
|                          image_fmt    = jpeg,
|                          image_dpi    = 300,
|                          image_width  = 650px,
|                          image_height = 650px,
|
|                          image_text_font    = "Times New Roman",
|                          image_title_size   = 14pt,
|                          image_title_style  = Normal,
|                          image_title_weight = Bold,
|
|                          image_yaxis_label_size   = 7pt,
```

```
|                         image_yaxis_label_style  = Normal,
|                         image_yaxis_label_weight = Normal,
|
|                         image_xaxis_label_size   = 10pt,
|                         image_xaxis_label_style  = Normal,
|                         image_xaxis_label_weight = Normal,
|
|                         image_marker_size   = 5,
|                         image_marker_weight = Normal,
|
|                         image_legend_size   = 9pt,
|                         image_legend_style  = Normal,
|                         image_legend_weight = Bold,
|                         image_legend_box    = 0
|                         );
|
*-------------------------------------------------------------------------------*
| REQUIRED PARAMETERS
|
| Name     : gpath
| Default  :
| Purpose  : Location of the plot
|
*-------------------------------------------------------------------------------*
| OPTIONAL PARAMETERS
|
| Name     : ASD_descending
| Default  : 1
| Purpose  : if 1, plot covariables in order of desending ASD (before matching)
|                         if 0, plot covariables in the same order as in the "ASD_plot_temp"
|                                 dateset
|
| Name     : cutoff
| Default  : 0.20
| Purpose  : Define cut off value for imblance:
|                               The maximum value allowed is 0.2 (Cohen 1988).
|                               Austin 2009 suggests: 1.96 × v(1/n1+1/n2).
|
| Name     : Image_blackwhite
| Default  : 0
| Purpose  : if 0, create color image
|                         if 1, create black and white image
|
| Name     : image_name
```

| Default : ASD_today's date
| Purpose : Name of plot
|
| Name : image_fmt
| Default : jpeg
| Purpose : Format of plot
|
| Name : image_dpi
| Default : 300
| Purpose : Resolution of plot
|
| Name : image_width
| Default : 650px
| Purpose : Width of plot
|
| Name : image_height
| Default : 650px
| Purpose : Height of plot
|
| Name : image_text_font
| Default : "Times New Roman"
| Purpose : Font of text in plot
|
| Name : image_title_size
| image_yaxis_label_size
| image_xaxis_label_size
| image_marker_size
| image_legend_size
| Default : 14pt 7pt 10pt 5 9pt
| Purpose : Size of title, y-axis label, x-axis label, marker, and legend
|
| Name : image_title_style
| image_yaxis_label_style
| image_xaxis_label_style
| image_legend_style
| Default : NORMAL
| Options : NORMAL | ITALIC
| Purpose : Style of title, y-axis label, x-axis label, and legend
|
| Name : image_title_weight
| image_yaxis_label_weight
| image_xaxis_label_weight
| image_marker_weight
| image_legend_weight

| Default : BOLD NORMAL NORMAL NORMAL NORMAL BOLD
| Options : NORMAL | BOLD
| Purpose : Weight of title, y-axis label, x-axis label, marker, and legend
|
| Name : image_legend_box
| Default : 0
| Purpose : if 1, a border is displayed around the legend
| if 0, no border is displayed around the legend
|

| RETURNED INFORMATION
|
| Plot of Absolute Standardized Difference before and after matching
|

| EXAMPLES

```
| data ASD_plot_temp;
|   input var $1-35 ASD1 ASD2;
|   format ASD1 ASD2 4.2;
| cards;
| Age                                          0.46  0.02
| Gender                                       0.56  0.05
| Race                                   0.19  0.02
| Body Mass Index                        0.04  0.04
| ASA status                             0.15  0.02
| Congestive heart failure         0.09  0
| Valvular disease                 0.03  0.01
| Pulmonary circulation disease    0.04  0.03
| Peripheral vascular disease  0.01  0.02
| Hypertension, uncomplicated      0.16  0.02
| Hypertension, complicated        0.17  0.05
| Paralysis                              0.06  0.02
| Other neurological disorders  0.07  0
| Chronic pulmonary disease        0.15  0.01
| Diabetes w/o chronic complications  0.07  0.03
| Diabetes w/ chronic complications  0.13  0.03
| Hypothyroidism                         0           0.01
| Renal failure                    0.24  0.01
| Liver disease                    0.12  0.05
| Acquired immune deficiency syndrome 0  0.01
| Lymphoma                               0.05  0.03
| Metastatic cancer                0           0.04
| Solid tumor w/out metastasis     0.17  0.01
| Rheumatoid arthritis/collagen vas  0.11  0.01
```

```
|                 Coagulopthy                                    0.03    0.03
|                 Obesity                                                0       0.03
|                 Weight loss                                    0.08    0.05
|                 Fluid and electrolyte disorders        0.03    0.02
|                 Chronic blood loss anemia                      0.03    0.02
|                 Deficiency Anemias                             0.13    0.05
|                 Alcohol abuse                                  0.02    0.02
|                 Drug abuse                                             0.06    0.02
|                 Psychoses                                              0.02    0
|                 Depression                                             0.2     0.03
|                 Hyperlipidemia                                 0.29    0.03
|                 Rhythm disturbance                             0.13    0.03
|                 Coronary artery disease                        0.08    0.03
|                 Transient ischemic attack                      0.07    0.01
|                 Ischemic Stroke                                0.04    0.01
|                 Hepatic disease                                        0.02    0.08
|                 Myocardial infaraction                         0.03    0
|                 Seizure disorder                               0.05    0.04
|                 Vascular surgery                               0.08    0.01
|                 CABG                                                   0.06    0.01
|                 PTCA                                                   0.03    0.03
|                 Emergency                                              0.02    0.02
|                 Duration of surgery                            0.11    0
|                 ;
|                 run;
|
|                 %ASDPlot(gpath  = H:\Temp);
|
*-------------------------------------------------------------------------------*/

%macro ASDPlot(gpath = ,
                        ASD_descending = 1,
                        cutoff = 0.20,
                        image_blackwhite = 0,
                        image_name   = ASD_plot,
                        image_fmt    = jpeg,
                    image_dpi    = 300,
                        image_width  = 650px,
                        image_height = 650px,

                        image_text_font    = "Times New Roman",
                        image_title_size   = 14pt,
                        image_title_style  = Normal,
                        image_title_weight = Bold,
```

```
                        image_yaxis_label_size   = 7pt,
                        image_yaxis_label_style  = Normal,
                        image_yaxis_label_weight = Normal,

                        image_xaxis_label_size   = 10pt,
                        image_xaxis_label_style  = Normal,
                        image_xaxis_label_weight = Normal,

                        image_marker_size   = 5,
                        image_marker_weight = Normal,

                        image_legend_size   = 9pt,
                        image_legend_style  = Normal,
                        image_legend_weight = Bold,
                        image_legend_box    = 0);

/************************/
/* SECTION 1: PLOT DATA */
/************************/
/* Obtain the maximum ASD before matching */
proc means data = ASD_plot_temp max;
        var ASD1;
        ods output summary = ASD_max;
run;
proc sql noprint;
        select ASD1_max into: ASD_max
        from ASD_max;
quit;

/* obtain the cut off value for imbalance */
Data cutoff;
        cutoff2 = min(&cutoff, 0.2);
run;
proc sql noprint;
        select cutoff2 into: cutoff2
        from cutoff;
quit;

/* If ASD_descending option is 1, then sort the covariables in the order of ASD before matching
from maximum to minimum */
%if &ASD_descending = 1 %then %do;
        proc sort data = ASD_plot_temp; by desending ASD1; run;
%end;
```

```
/* Calculate the x-axis limit */
data ASD_plot;
        set ASD_plot_temp;
        Matching = "Before Matching"; ASD = ASD1;  output;
   Matching = "After Matching";  ASD = ASD2;  output;
run;
Data ASD_plot;
        set ASD_plot;
        if mod(_n_, 4) = 1 and Matching = 'Before Matching' then barht = &ASD_max * 1.1;
        drop ASD1 ASD2;
run;


/*************************/
/* SECTION 2: PLOT FORMAT */
/*************************/
/* plot ods path */
ods path   work.templat(update)
       sashelp.tmplmst  (read);

/* plot format */
%if &image_blackwhite = 0 %then %do;
        proc template;
                define Style ASDstyle;
                   parent = styles.journal;
                        style GraphAxisLines  from GraphAxisLines / ContrastColor = black
LineThickness  = 1.5;
                        style GraphWalls / lineThickness = 1px FrameBorder = off;
                        style graphdata1 / LineStyle = 1 color = red  ContrastColor = red;
                        style graphdata2 / LineStyle = 1 Color = blue ContrastColor = blue;
                end;
        run;
%end;

%else %do;
        proc template;
                define Style ASDstyle;
                   parent = styles.journal;
                        style GraphAxisLines  from GraphAxisLines / ContrastColor = black
LineThickness  = 1.5;
                        style GraphWalls / lineThickness = 1px FrameBorder = off;
                        style graphdata1 / LineStyle = 1 color = black ContrastColor = black
MarkerSymbol = "circle";
```

```
                        style graphdata2 / LineStyle = 1 Color = black ContrastColor = black
MarkerSymbol = "triangle";
                end;
        run;
%end;

/*******************/
/* SECTION 3: PLOT */
/*******************/
proc template;
        define statgraph ASDPlot;
        begingraph / designwidth = &image_width designheight = &image_height;
        entrytitle "Absolute Standardized Difference" /       textattrs=(FAMILY =
&image_text_font style = &image_title_style weight = &image_title_weight size =
&image_title_size)  pad = (bottom = 5px);
                layout overlay / yaxisopts  = (display = (tickvalues)                    tickvalueattrs
= (FAMILY = &image_text_font style = &image_yaxis_label_style weight =
&image_yaxis_label_weight size = &image_yaxis_label_size) reverse = true )
                        xaxisopts  = (display = (ticks tickvalues line) tickvalueattrs = (FAMILY =
&image_text_font style = &image_xaxis_label_style weight = &image_xaxis_label_weight size =
&image_xaxis_label_size))
                        x2axisopts = (display = none);
                            barchart x = var y = barht / xaxis = x2 orient=horizontal display=(fill)
datatransparency = 0.5;
                            scatterplot y = var x = asd /group = matching name = 'scatter' markerattrs
= (size = &image_marker_size weight = &image_marker_weight);
                %if &image_legend_box = 1 %then %do;
                                    discretelegend 'scatter' / BORDER = TRUE ACROSS = 1 location =
inside HALIGN = right VALIGN = bottom OUTERPAD=(bottom=10px) PAD=(bottom=2px top =
2px left = 2px right = 2px)

VALUEATTRS=(FAMILY = &image_text_font style = &image_legend_style weight =
&image_legend_weight size = &image_legend_size);
                            %end;
                                    %else %do;
                                            discretelegend 'scatter' / BORDER = False ACROSS = 1
location = inside HALIGN = right VALIGN = bottom OUTERPAD = (bottom = 10px) PAD =
(bottom=2px top = 2px left = 2px right = 2px)

VALUEATTRS=(FAMILY = &image_text_font style = &image_legend_style weight =
&image_legend_weight size = &image_legend_size);
                                    %end;
                            referenceline x = &cutoff2 / lineattrs = (pattern = solid);
                endlayout;
```

```
        endgraph;
        end;
run;



title;
options nodate nonumber;

ods listing
                        style     = ASDstyle
                        gpath     = "&gpath."
                        image_dpi  = &image_dpi;

ods graphics on/reset
                    imagefmt  = &image_fmt
                       imagemap  = on
                       imagename = "&image_name."
                       border    = off
                          SCALE     = on;

proc sgrender data = ASD_plot template = ASDPlot;
run;
ods graphics off;

%mend;
```