Standardized Mean Differences (SMD)

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Purpose

To create a SMD statistic in the style of tableone inside of tangram. See 'Using standardized mean differences' by Kazuki Yoshida for original work and description of method. This is a reproduction of the original document using `tangram`.

Load Packages and Data

The right heart catheterization dataset is available at http://biostat.mc.vanderbilt.edu/wiki/Main/DataSets . This dataset was originally used in Connors et al. JAMA 1996;276:889-897, and has been made publicly available.

```
library(Matching)
```

```
## Loading required package: MASS
```

```
## ##
## ##  Matching (Version 4.9-7, Build Date: 2020-02-05)
## ##  See http://sekhon.berkeley.edu/matching for additional documentation.
## ##  Please cite software as:
## ##   Jasjeet S. Sekhon. 2011. ``Multivariate and Propensity Score Matching
## ##   Software with Automated Balance Optimization: The Matching package for R.''
## ##   Journal of Statistical Software, 42(7): 1-52.
## ##
```

```
library(tangram)
```

```
## Loading required package: R6
```

```
## Loading required package: magrittr
```

```
## Loading required package: knitr
```

```
## Right heart cath dataset
rhc <- read.csv("http://biostat.mc.vanderbilt.edu/wiki/pub/Main/DataSets/rhc.csv")
```

Unmatched table

```
vars <- c("age","sex","race","edu","income","ninsclas","cat1","das2d3pc","dnr1",
          "ca","surv2md1","aps1","scoma1","wtkilo1","temp1","meanbp1","resp1",
          "hrt1","pafi1","paco21","ph1","wblc1","hema1","sod1","pot1","crea1",
          "bili1","alb1","resp","card","neuro","gastr","renal","meta","hema",
          "seps","trauma","ortho","cardiohx","chfhx","dementhx","psychhx",
          "chrpulhx","renalhx","liverhx","gibledhx","malighx","immunhx",
          "transhx","amihx")
```

```
formula <- paste0("swang1~", paste0(vars, collapse="+"))

tangram(formula, rhc, "unmatched", smd, "Unmatched", style="nejm", relsize=-2, test=TRUE)
```

Table 1: Unmatched

Table 1: Unmatched

	N	No RHC (N=3551)	RHC (N=2184)	SMD	Test Statistic
age	5735	61.76 (17.29)	60.75 (15.63)	0.061	$F_{1,5733}$=8.54, P<0.01[3]
sex : Male	5735	1914 (53.90)	1278 (58.52)	0.093	χ^2_1=11.68, P<0.01[2]
race	5735			0.036	χ^2_2=1.71, P=0.43[2]
black		585 (16.47)	335 (15.34)		
other		213 (6.00)	142 (6.50)		
white		2753 (77.53)	1707 (78.16)		
edu	5735	11.57 (3.13)	11.86 (3.16)	0.091	$F_{1,5733}$=14.91, P<0.01[3]
income	5735			0.142	χ^2_3=27.38, P<0.01[2]
> 50k		257 (7.24)	194 (8.88)		
11-25k		713 (20.08)	452 (20.70)		
25-50k		500 (14.08)	393 (17.99)		
Under 11k		2081 (58.60)	1145 (52.43)		
ninsclas	5735			0.194	χ^2_5=50.07, P<0.01[2]
Medicaid		454 (12.79)	193 (8.84)		
Medicare		947 (26.67)	511 (23.40)		
Medicare & Medicaid		251 (7.07)	123 (5.63)		
No insurance		186 (5.24)	136 (6.23)		
Private		967 (27.23)	731 (33.47)		
Private & Medicare		746 (21.01)	490 (22.44)		
cat1	5735			0.583	χ^2_8=413.07, P<0.01[2]
ARF		1581 (44.52)	909 (41.62)		
CHF		247 (6.96)	209 (9.57)		
Cirrhosis		175 (4.93)	49 (2.24)		
Colon Cancer		6 (0.17)	1 (0.05)		
Coma		341 (9.60)	95 (4.35)		
COPD		399 (11.24)	58 (2.66)		
Lung Cancer		34 (0.96)	5 (0.23)		
MOSF w/Malignancy		241 (6.79)	158 (7.23)		
MOSF w/Sepsis		527 (14.84)	700 (32.05)		
das2d3pc	5735	20.37 (5.48)	20.70 (5.03)	0.063	$F_{1,5733}$=10.30, P<0.01[3]
dnr1 : Yes	5735	499 (14.05)	155 (7.10)	0.228	χ^2_1=64.75, P<0.01[2]
ca	5735			0.107	χ^2_2=15.08, P<0.01[2]
Metastatic		261 (7.35)	123 (5.63)		
No		2652 (74.68)	1727 (79.08)		
Yes		638 (17.97)	334 (15.29)		
surv2md1	5735	0.61 (0.19)	0.57 (0.20)	0.198	$F_{1,5733}$=58.85, P<0.01[3]
aps1	5735	50.93 (18.81)	60.74 (20.27)	0.501	$F_{1,5733}$=348.06, P<0.01[3]
scoma1	5735	22.25 (31.37)	18.97 (28.26)	0.110	$F_{1,5733}$=11.58, P<0.01[3]
wtkilo1	5735	65.04 (29.50)	72.36 (27.73)	0.256	$F_{1,5733}$=127.12, P<0.01[3]
temp1	5735	37.63 (1.74)	37.59 (1.83)	0.021	$F_{1,5733}$=0.09, P=0.77[3]
meanbp1	5735	84.87 (38.87)	68.20 (34.24)	0.455	$F_{1,5733}$=268.84, P<0.01[3]
resp1	5735	28.98 (13.95)	26.65 (14.17)	0.165	$F_{1,5733}$=35.45, P<0.01[3]
hrt1	5735	112.87 (40.94)	118.93 (41.47)	0.147	$F_{1,5733}$=40.22, P<0.01[3]
pafi1	5735	240.63 (116.66)	192.43 (105.54)	0.433	$F_{1,5733}$=259.79, P<0.01[3]
paco21	5735	39.95 (14.24)	36.79 (10.97)	0.249	$F_{1,5733}$=66.46, P<0.01[3]
ph1	5735	7.39 (0.11)	7.38 (0.11)	0.120	$F_{1,5733}$=22.23, P<0.01[3]
wblc1	5735	15.26 (11.41)	16.27 (12.55)	0.084	$F_{1,5733}$=11.54, P<0.01[3]
hema1	5735	32.70 (8.79)	30.51 (7.42)	0.269	$F_{1,5733}$=92.55, P<0.01[3]
sod1	5735	137.04 (7.68)	136.33 (7.60)	0.092	$F_{1,5733}$=14.87, P<0.01[3]
pot1	5735	4.08 (1.04)	4.05 (1.01)	0.027	$F_{1,5733}$=1.45, P=0.23[3]
crea1	5735	1.92 (2.03)	2.47 (2.05)	0.270	$F_{1,5733}$=279.35, P<0.01[3]
bili1	5735	2.00 (4.43)	2.71 (5.33)	0.145	$F_{1,5733}$=95.26, P<0.01[3]
alb1	5735	3.16 (0.67)	2.98 (0.93)	0.230	$F_{1,5733}$=79.92, P<0.01[3]
resp : Yes	5735	1481 (41.71)	632 (28.94)	0.270	χ^2_1=94.75, P<0.01[2]
card : Yes	5735	1007 (28.36)	924 (42.31)	0.295	χ^2_1=117.82, P<0.01[2]
neuro : Yes	5735	575 (16.19)	118 (5.40)	0.353	χ^2_1=148.19, P<0.01[2]
gastr : Yes	5735	522 (14.70)	420 (19.23)	0.121	χ^2_1=20.22, P<0.01[2]

renal : Yes	5735	147 (4.14)	148 (6.78)	0.116	χ^2_1=19.27, P<0.01[2]
meta : Yes	5735	172 (4.84)	93 (4.26)	0.028	χ^2_1=1.05, P=0.31[2]
hema : Yes	5735	239 (6.73)	115 (5.27)	0.062	χ^2_1=5.01, P=0.03[2]
seps : Yes	5735	515 (14.50)	516 (23.63)	0.234	χ^2_1=76.34, P<0.01[2]
trauma : Yes	5735	18 (0.51)	34 (1.56)	0.104	χ^2_1=16.59, P<0.01[2]
ortho : Yes	5735	3 (0.08)	4 (0.18)	0.027	χ^2_1=1.08, P=0.30[2]
cardiohx	5735	0.16 (0.37)	0.20 (0.40)	0.116	$F_{1,5733}$=18.50, P<0.01[3]
chfhx	5735	0.17 (0.37)	0.19 (0.40)	0.070	$F_{1,5733}$=6.62, P=0.01[3]
dementhx	5735	0.12 (0.32)	0.07 (0.25)	0.163	$F_{1,5733}$=34.12, P<0.01[3]
psychhx	5735	0.08 (0.27)	0.05 (0.21)	0.143	$F_{1,5733}$=26.13, P<0.01[3]
chrpulhx	5735	0.22 (0.41)	0.14 (0.35)	0.192	$F_{1,5733}$=48.18, P<0.01[3]
renalhx	5735	0.04 (0.20)	0.05 (0.21)	0.032	$F_{1,5733}$=1.38, P=0.24[3]
liverhx	5735	0.07 (0.26)	0.06 (0.24)	0.049	$F_{1,5733}$=3.18, P=0.07[3]
gibledhx	5735	0.04 (0.19)	0.02 (0.16)	0.070	$F_{1,5733}$=6.42, P=0.01[3]
malighx	5735	0.25 (0.43)	0.20 (0.40)	0.101	$F_{1,5733}$=13.69, P<0.01[3]
immunhx	5735	0.26 (0.44)	0.29 (0.45)	0.080	$F_{1,5733}$=8.82, P<0.01[3]
transhx	5735	0.09 (0.29)	0.15 (0.36)	0.170	$F_{1,5733}$=40.90, P<0.01[3]
amihx	5735	0.03 (0.17)	0.04 (0.20)	0.074	$F_{1,5733}$=7.80, P=0.01[3]

Numerical summary is mean (sd). Categorical is N(%). [1]Kruskal-Wallis. [2]Pearson.

Propensity Score Matching

```
## Fit model
psModel <- glm(formula = formula,
               family  = binomial(link = "logit"),
               data    = rhc)

## Predicted probability of being assigned to RHC
rhc$pRhc <- predict(psModel, type = "response")
## Predicted probability of being assigned to no RHC
rhc$pNoRhc <- 1 - rhc$pRhc

## Predicted probability of being assigned to the
## treatment actually assigned (either RHC or no RHC)
rhc$pAssign <- NA
rhc$pAssign[rhc$swang1 == "RHC"]    <- rhc$pRhc[rhc$swang1    == "RHC"]
rhc$pAssign[rhc$swang1 == "No RHC"] <- rhc$pNoRhc[rhc$swang1 == "No RHC"]
## Smaller of pRhc vs pNoRhc for matching weight
rhc$pMin <- pmin(rhc$pRhc, rhc$pNoRhc)

listMatch <- Match(Tr       = (rhc$swang1 == "RHC"),      # Need to be in 0,1
                   ## logit of PS,i.e., log(PS/(1-PS)) as matching scale
                   X        = log(rhc$pRhc / rhc$pNoRhc),
                   ## 1:1 matching
                   M        = 1,
                   ## caliper = 0.2 * SD(logit(PS))
                   caliper  = 0.2,
                   replace  = FALSE,
                   ties     = TRUE,
                   version  = "fast")
## Extract matched data
rhcMatched <- rhc[unlist(listMatch[c("index.treated","index.control")]), ]

tangram(formula, rhcMatched, "matched", smd, "Propensity Score Matched", style="nejm", relsize=-2)
```

Table 2: Propensity Score Matched

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	N	No RHC (N=1563)	RHC (N=1563)	SMD
age	3126	60.82 (16.97)	60.55 (15.71)	0.017
sex : Male	3126	875 (55.98)	891 (57.01)	0.021
race	3126			0.005
black		245 (15.67)	248 (15.87)	
other		99 (6.33)	99 (6.33)	
white		1219 (77.99)	1216 (77.80)	
edu	3126	11.85 (3.16)	11.78 (3.16)	0.023
income	3126			0.026
> 50k		126 (8.06)	124 (7.93)	
11-25k		320 (20.47)	336 (21.50)	
25-50k		261 (16.70)	262 (16.76)	
Under 11k		856 (54.77)	841 (53.81)	
ninsclas	3126			0.036
Medicaid		154 (9.85)	152 (9.72)	
Medicare		385 (24.63)	370 (23.67)	
Medicare & Medicaid		88 (5.63)	94 (6.01)	
No insurance		82 (5.25)	90 (5.76)	
Private		504 (32.25)	498 (31.86)	
Private & Medicare		350 (22.39)	359 (22.97)	
cat1	3126			0.076
ARF		716 (45.81)	680 (43.51)	
CHF		164 (10.49)	175 (11.20)	
Cirrhosis		47 (3.01)	47 (3.01)	
Colon Cancer		0 (0.00)	1 (0.06)	
Coma		75 (4.80)	76 (4.86)	
COPD		49 (3.13)	57 (3.65)	
Lung Cancer		2 (0.13)	5 (0.32)	
MOSF w/Malignancy		131 (8.38)	128 (8.19)	
MOSF w/Sepsis		379 (24.25)	394 (25.21)	
das2d3pc	3126	20.37 (5.42)	20.58 (5.08)	0.041
dnr1 : Yes	3126	142 (9.09)	130 (8.32)	0.027
ca	3126			0.021
Metastatic		106 (6.78)	98 (6.27)	
No		1189 (76.07)	1194 (76.39)	
Yes		268 (17.15)	271 (17.34)	
surv2md1	3126	0.58 (0.20)	0.59 (0.20)	0.032
aps1	3126	57.41 (19.58)	57.26 (19.65)	0.008
scoma1	3126	18.55 (28.49)	18.87 (28.25)	0.012
wtkilo1	3126	70.10 (26.57)	70.73 (27.19)	0.024
temp1	3126	37.66 (1.90)	37.62 (1.74)	0.020
meanbp1	3126	73.16 (35.50)	73.09 (35.73)	0.002
resp1	3126	28.55 (13.87)	28.07 (14.17)	0.034
hrt1	3126	117.32 (42.53)	117.77 (40.24)	0.011
pafi1	3126	207.84 (106.25)	211.26 (107.98)	0.032
paco21	3126	37.51 (10.74)	37.46 (11.56)	0.004
ph1	3126	7.39 (0.11)	7.39 (0.11)	0.002
wblc1	3126	15.74 (11.88)	15.93 (13.00)	0.016
hema1	3126	30.74 (8.02)	30.89 (7.53)	0.020
sod1	3126	136.49 (7.86)	136.64 (7.42)	0.019
pot1	3126	4.04 (1.03)	4.04 (0.99)	0.003
crea1	3126	2.29 (2.38)	2.28 (1.97)	0.003
bili1	3126	2.52 (5.47)	2.55 (5.09)	0.006
alb1	3126	3.05 (0.70)	3.04 (0.96)	0.008
resp : Yes	3126	539 (34.48)	519 (33.21)	0.027
card : Yes	3126	592 (37.88)	598 (38.26)	0.008
neuro : Yes	3126	116 (7.42)	109 (6.97)	0.017
gastr : Yes	3126	277 (17.72)	291 (18.62)	0.023
renal : Yes	3126	90 (5.76)	94 (6.01)	0.011
meta : Yes	3126	69 (4.41)	74 (4.73)	0.015
hema : Yes	3126	98 (6.27)	97 (6.21)	0.003
seps : Yes	3126	334 (21.37)	332 (21.24)	0.003
trauma : Yes	3126	14 (0.90)	13 (0.83)	0.007
ortho : Yes	3126	2 (0.13)	1 (0.06)	0.021

cardiohx	3126	0.20 (0.40)	0.20 (0.40)	0.008
chfhx	3126	0.20 (0.40)	0.20 (0.40)	0.013
dementhx	3126	0.08 (0.27)	0.07 (0.26)	0.014
psychhx	3126	0.05 (0.22)	0.05 (0.23)	0.006
chrpulhx	3126	0.16 (0.36)	0.15 (0.36)	0.009
renalhx	3126	0.05 (0.22)	0.05 (0.22)	0.014
liverhx	3126	0.07 (0.26)	0.07 (0.26)	0.005
gibledhx	3126	0.03 (0.17)	0.03 (0.17)	<0.001
malighx	3126	0.23 (0.42)	0.23 (0.42)	0.008
immunhx	3126	0.29 (0.46)	0.28 (0.45)	0.035
transhx	3126	0.12 (0.32)	0.12 (0.33)	0.014
amihx	3126	0.04 (0.18)	0.03 (0.17)	0.025

Numerical summary is mean (sd). Categorical is N(%). [1]Kruskal-Wallis. [2]Pearson.

Propensity Score Matching Weight

```
tangram(formula, rhc, "weighted", smd,
        "Propensity Score Weighted",
        style="nejm",
        weight=rhc$pMin/rhc$pAssign, relsize=-2)
```

Table 3: Propensity Score Weighted

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	N	No RHC (N=3551)	RHC (N=2184)	SMD
age	5735	61.76 (17.29)	60.75 (15.63)	0.003
sex : Male	5735	1914 (53.90)	1278 (58.52)	0.003
race	5735			0.009
black		585 (16.47)	335 (15.34)	
other		213 (6.00)	142 (6.50)	
white		2753 (77.53)	1707 (78.16)	
edu	5735	11.57 (3.13)	11.86 (3.16)	0.002
income	5735			0.004
> 50k		257 (7.24)	194 (8.88)	
11-25k		713 (20.08)	452 (20.70)	
25-50k		500 (14.08)	393 (17.99)	
Under 11k		2081 (58.60)	1145 (52.43)	
ninsclas	5735			0.014
Medicaid		454 (12.79)	193 (8.84)	
Medicare		947 (26.67)	511 (23.40)	
Medicare & Medicaid		251 (7.07)	123 (5.63)	
No insurance		186 (5.24)	136 (6.23)	
Private		967 (27.23)	731 (33.47)	
Private & Medicare		746 (21.01)	490 (22.44)	
cat1	5735			0.017
ARF		1581 (44.52)	909 (41.62)	
CHF		247 (6.96)	209 (9.57)	
Cirrhosis		175 (4.93)	49 (2.24)	
Colon Cancer		6 (0.17)	1 (0.05)	
Coma		341 (9.60)	95 (4.35)	
COPD		399 (11.24)	58 (2.66)	
Lung Cancer		34 (0.96)	5 (0.23)	
MOSF w/Malignancy		241 (6.79)	158 (7.23)	
MOSF w/Sepsis		527 (14.84)	700 (32.05)	
das2d3pc	5735	20.37 (5.48)	20.70 (5.03)	0.005
dnr1 : Yes	5735	499 (14.05)	155 (7.10)	0.005
ca	5735			0.006
Metastatic		261 (7.35)	123 (5.63)	
No		2652 (74.68)	1727 (79.08)	
Yes		638 (17.97)	334 (15.29)	
surv2md1	5735	0.61 (0.19)	0.57 (0.20)	0.011
aps1	5735	50.93 (18.81)	60.74 (20.27)	0.008
scoma1	5735	22.25 (31.37)	18.97 (28.26)	0.001
wtkilo1	5735	65.04 (29.50)	72.36 (27.73)	<0.001

temp1	5735	37.63 (1.74)	37.59 (1.83)	<0.001
meanbp1	5735	84.87 (38.87)	68.20 (34.24)	0.001
resp1	5735	28.98 (13.95)	26.65 (14.17)	0.004
hrt1	5735	112.87 (40.94)	118.93 (41.47)	0.006
pafi1	5735	240.63 (116.66)	192.43 (105.54)	0.003
paco21	5735	39.95 (14.24)	36.79 (10.97)	0.004
ph1	5735	7.39 (0.11)	7.38 (0.11)	0.003
wblc1	5735	15.26 (11.41)	16.27 (12.55)	0.011
hema1	5735	32.70 (8.79)	30.51 (7.42)	0.007
sod1	5735	137.04 (7.68)	136.33 (7.60)	0.005
pot1	5735	4.08 (1.04)	4.05 (1.01)	0.004
crea1	5735	1.92 (2.03)	2.47 (2.05)	<0.001
bili1	5735	2.00 (4.43)	2.71 (5.33)	0.009
alb1	5735	3.16 (0.67)	2.98 (0.93)	<0.001
resp : Yes	5735	1481 (41.71)	632 (28.94)	0.004
card : Yes	5735	1007 (28.36)	924 (42.31)	0.006
neuro : Yes	5735	575 (16.19)	118 (5.40)	0.001
gastr : Yes	5735	522 (14.70)	420 (19.23)	0.005
renal : Yes	5735	147 (4.14)	148 (6.78)	0.004
meta : Yes	5735	172 (4.84)	93 (4.26)	0.001
hema : Yes	5735	239 (6.73)	115 (5.27)	0.004
seps : Yes	5735	515 (14.50)	516 (23.63)	0.005
trauma : Yes	5735	18 (0.51)	34 (1.56)	0.003
ortho : Yes	5735	3 (0.08)	4 (0.18)	0.003
cardiohx	5735	0.16 (0.37)	0.20 (0.40)	<0.001
chfhx	5735	0.17 (0.37)	0.19 (0.40)	0.004
dementhx	5735	0.12 (0.32)	0.07 (0.25)	0.003
psychhx	5735	0.08 (0.27)	0.05 (0.21)	0.004
chrpulhx	5735	0.22 (0.41)	0.14 (0.35)	0.001
renalhx	5735	0.04 (0.20)	0.05 (0.21)	0.001
liverhx	5735	0.07 (0.26)	0.06 (0.24)	0.003
gibledhx	5735	0.04 (0.19)	0.02 (0.16)	0.007
malighx	5735	0.25 (0.43)	0.20 (0.40)	0.007
immunhx	5735	0.26 (0.44)	0.29 (0.45)	<0.001
transhx	5735	0.09 (0.29)	0.15 (0.36)	0.004
amihx	5735	0.03 (0.17)	0.04 (0.20)	0.006

Numerical summary is mean (sd). Categorical is N(%). [1]Kruskal-Wallis. [2]Pearson.