running-MANOVA-imputed

2022-09-15

library(tidyverse)

## ── Attaching packages ─────────────────────────────────────── tidyverse 1.3.2 ──  
## ✔ ggplot2 3.3.6 ✔ purrr 0.3.4  
## ✔ tibble 3.1.8 ✔ dplyr 1.0.9  
## ✔ tidyr 1.2.0 ✔ stringr 1.4.0  
## ✔ readr 2.1.2 ✔ forcats 0.5.1  
## ── Conflicts ────────────────────────────────────────── tidyverse\_conflicts() ──  
## ✖ dplyr::filter() masks stats::filter()  
## ✖ dplyr::lag() masks stats::lag()

library(readxl)  
library(flextable)

##   
## Attaching package: 'flextable'  
##   
## The following object is masked from 'package:purrr':  
##   
## compose

library(extrafont)

## Registering fonts with R

library(writexl)  
library(car) #Manova function

## Loading required package: carData  
##   
## Attaching package: 'car'  
##   
## The following object is masked from 'package:dplyr':  
##   
## recode  
##   
## The following object is masked from 'package:purrr':  
##   
## some

library(broom) #tidy function  
library(emmeans) #emmeans function

#times new roman tables  
my\_ft\_theme <- function(ft, ...) {  
 # Remove vertical cell padding  
 ft <- padding(ft, padding.top = 0, padding.bottom = 0, part = "all")  
   
 # Change font to TNR 11  
 ft <- font(ft, fontname = "Times New Roman", part = "all")  
 ft <- fontsize(ft, part = "all", size = 12)  
 ft  
}

chosen\_imputed1 <- read\_excel("C:\\Users\\19177\\OneDrive - Colostate\\Desktop\\Dissertation\\headscan\_dissertation\\chosen\_imputed1.xlsx")  
  
chosen\_imputed1$gender <- as.factor(chosen\_imputed1$gender)  
chosen\_imputed1$race\_eth <- as.factor(chosen\_imputed1$race\_eth)  
chosen\_imputed1$age\_group <- as.factor(chosen\_imputed1$age\_group)  
  
  
  
summary(chosen\_imputed1)

## ID AA\_C BiW\_C BiW\_L   
## Length:2016 Min. :44.00 Min. :101.0 Min. : 82.0   
## Class :character 1st Qu.:57.00 1st Qu.:124.0 1st Qu.:105.0   
## Mode :character Median :61.00 Median :133.0 Median :111.0   
## Mean :61.22 Mean :133.4 Mean :111.2   
## 3rd Qu.:65.00 3rd Qu.:141.0 3rd Qu.:117.0   
## Max. :87.00 Max. :187.0 Max. :152.0   
## GoSub\_C NRB\_L ProS\_L SelP\_L SelM\_L   
## Min. : 49.00 Min. : 3.00 Min. :12.00 Min. :30.00 Min. : 84   
## 1st Qu.: 89.00 1st Qu.:15.00 1st Qu.:17.00 1st Qu.:42.00 1st Qu.:111   
## Median : 99.00 Median :18.00 Median :19.00 Median :44.00 Median :117   
## Mean : 99.17 Mean :17.95 Mean :19.12 Mean :44.53 Mean :117   
## 3rd Qu.:109.00 3rd Qu.:21.00 3rd Qu.:21.00 3rd Qu.:47.00 3rd Qu.:123   
## Max. :152.00 Max. :35.00 Max. :27.00 Max. :58.00 Max. :145   
## SnasM\_C TrSman\_C TrTr\_C TrTr\_L gender   
## Min. : 44.00 Min. :117.0 Min. :241.0 Min. :127.0 Female:1063   
## 1st Qu.: 69.00 1st Qu.:144.0 1st Qu.:273.0 1st Qu.:141.0 Male : 939   
## Median : 76.00 Median :154.0 Median :283.0 Median :146.0 Other : 14   
## Mean : 75.62 Mean :153.8 Mean :282.7 Mean :146.5   
## 3rd Qu.: 83.00 3rd Qu.:162.0 3rd Qu.:292.0 3rd Qu.:152.0   
## Max. :105.00 Max. :208.0 Max. :332.0 Max. :173.0   
## race\_eth age\_group   
## Asian : 91 18-36:991   
## Black : 548 37-54:940   
## LatinX: 100 55-72: 84   
## Other : 38 NA's : 1   
## white :1239   
##

chosen\_imputed1$gender <-  
 recode\_factor(chosen\_imputed1$gender, 'Female'= "Female/Other",  
 'Other' = "Female/Other")  
  
summary(chosen\_imputed1$gender)

## Female/Other Male   
## 1077 939

variables <- cbind(chosen\_imputed1$AA\_C, chosen\_imputed1$BiW\_C, chosen\_imputed1$BiW\_L,   
 chosen\_imputed1$GoSub\_C, chosen\_imputed1$NRB\_L, chosen\_imputed1$ProS\_L,  
 chosen\_imputed1$SelP\_L, chosen\_imputed1$SelM\_L, chosen\_imputed1$SnasM\_C,  
 chosen\_imputed1$TrSman\_C, chosen\_imputed1$TrTr\_C, chosen\_imputed1$TrTr\_L)

#<https://www.hindawi.com/journals/cmmm/2019/2173638/> Use Pillai! better for when we don’t know enough about covariance

#<https://www.sagepub.com/sites/default/files/upm-assets/9761_book_item_9761.pdf> Type III sum of squares can be used in models where there are uneven group sizes, although there needs to be at least one participant in each cell. It calculates the sum of squares after the independent variables have all been adjusted for the inclusion of all other independent variables in the model

output<-lm(variables ~ gender+race\_eth+age\_group, data=chosen\_imputed1,  
 contrasts = list(gender=contr.sum, race\_eth=contr.sum, age\_group=contr.sum))  
  
manova\_out\_imputed1 <- Manova(output, type="III")  
  
summary(manova\_out\_imputed1)

##   
## Type III MANOVA Tests:  
##   
## Sum of squares and products for error:  
## [,1] [,2] [,3] [,4] [,5] [,6]  
## [1,] 54793.3952 -5411.079 -9940.926 18920.871 -552.2324 11810.575  
## [2,] -5411.0786 277371.858 196174.263 -27194.131 23060.2600 -8221.336  
## [3,] -9940.9261 196174.263 169009.311 12466.804 22047.1716 -7730.625  
## [4,] 18920.8714 -27194.131 12466.804 328191.820 5533.4549 15430.208  
## [5,] -552.2324 23060.260 22047.172 5533.455 41231.8266 -1243.920  
## [6,] 11810.5752 -8221.336 -7730.625 15430.208 -1243.9201 10993.338  
## [7,] 10878.0548 16753.756 6132.753 -11223.624 -215.5716 1326.531  
## [8,] 826.1138 97525.934 76321.892 17202.876 22651.3911 1486.520  
## [9,] -13812.2666 122004.048 101449.971 2863.397 28653.4656 -7217.293  
## [10,] 21364.1120 53069.078 69844.563 223623.487 21157.4467 10929.394  
## [11,] 29731.4682 97487.845 99274.724 120767.643 18046.4793 7305.866  
## [12,] 13228.1320 35457.994 42099.913 64592.700 5733.3405 4389.435  
## [,7] [,8] [,9] [,10] [,11] [,12]  
## [1,] 10878.05485 826.1138 -13812.267 21364.11203 29731.468 13228.1320  
## [2,] 16753.75569 97525.9335 122004.048 53069.07777 97487.845 35457.9940  
## [3,] 6132.75250 76321.8916 101449.971 69844.56289 99274.724 42099.9130  
## [4,] -11223.62390 17202.8764 2863.397 223623.48654 120767.643 64592.7003  
## [5,] -215.57160 22651.3911 28653.466 21157.44670 18046.479 5733.3405  
## [6,] 1326.53144 1486.5195 -7217.293 10929.39429 7305.866 4389.4348  
## [7,] 29209.03222 26883.1148 9105.681 49.94439 10347.956 955.1423  
## [8,] 26883.11480 130113.6192 127444.862 53086.88878 58725.643 17177.6614  
## [9,] 9105.68064 127444.8617 170490.258 44506.74887 49278.275 13384.2990  
## [10,] 49.94439 53086.8888 44506.749 252252.82660 160408.596 78500.8818  
## [11,] 10347.95643 58725.6429 49278.275 160408.59588 280275.841 85259.1731  
## [12,] 955.14227 17177.6614 13384.299 78500.88181 85259.173 68266.5942  
##   
## ------------------------------------------  
##   
## Term: (Intercept)   
##   
## Sum of squares and products for the hypothesis:  
## [,1] [,2] [,3] [,4] [,5] [,6] [,7]  
## [1,] 1268688.3 2716020.1 2278218.6 2062952.0 368398.9 386361.0 920059.9  
## [2,] 2716020.1 5814482.3 4877232.6 4416387.8 788672.0 827125.4 1969673.2  
## [3,] 2278218.6 4877232.6 4091060.3 3704500.1 661544.2 693799.1 1652177.1  
## [4,] 2062952.0 4416387.8 3704500.1 3354465.6 599035.5 628242.8 1496064.5  
## [5,] 368398.9 788672.0 661544.2 599035.5 106974.9 112190.7 267165.0  
## [6,] 386361.0 827125.4 693799.1 628242.8 112190.7 117660.8 280191.2  
## [7,] 920059.9 1969673.2 1652177.1 1496064.5 267165.0 280191.2 667232.7  
## [8,] 2385824.5 5107596.3 4284291.1 3879472.8 692790.5 726569.0 1730213.5  
## [9,] 1534136.2 3284293.6 2754890.8 2494583.9 445479.1 467199.4 1112564.2  
## [10,] 3182242.7 6812576.2 5714441.4 5174489.6 924052.7 969106.8 2307780.5  
## [11,] 5841926.0 12506451.9 10490508.2 9499270.6 1696365.7 1779075.6 4236597.9  
## [12,] 3041215.5 6510663.7 5461194.9 4945172.1 883101.5 926159.0 2205506.7  
## [,8] [,9] [,10] [,11] [,12]  
## [1,] 2385824.5 1534136.2 3182242.7 5841926 3041215.5  
## [2,] 5107596.3 3284293.6 6812576.2 12506452 6510663.7  
## [3,] 4284291.1 2754890.8 5714441.4 10490508 5461194.9  
## [4,] 3879472.8 2494583.9 5174489.6 9499271 4945172.1  
## [5,] 692790.5 445479.1 924052.7 1696366 883101.5  
## [6,] 726569.0 467199.4 969106.8 1779076 926159.0  
## [7,] 1730213.5 1112564.2 2307780.5 4236598 2205506.7  
## [8,] 4486648.7 2885011.1 5984348.5 10986001 5719140.6  
## [9,] 2885011.1 1855123.8 3848064.0 7064233 3677529.7  
## [10,] 5984348.5 3848064.0 7981999.4 14653266 7628261.7  
## [11,] 10986000.8 7064233.4 14653266.1 26900304 14003878.3  
## [12,] 5719140.6 3677529.7 7628261.7 14003878 7290200.5  
##   
## Multivariate Tests: (Intercept)  
## Df test stat approx F num Df den Df Pr(>F)   
## Pillai 1 0.99369 26189.86 12 1996 < 2.22e-16 \*\*\*  
## Wilks 1 0.00631 26189.86 12 1996 < 2.22e-16 \*\*\*  
## Hotelling-Lawley 1 157.45408 26189.86 12 1996 < 2.22e-16 \*\*\*  
## Roy 1 157.45408 26189.86 12 1996 < 2.22e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## ------------------------------------------  
##   
## Term: gender   
##   
## Sum of squares and products for the hypothesis:  
## [,1] [,2] [,3] [,4] [,5] [,6] [,7]  
## [1,] 19452.687 29390.600 13779.976 36983.143 -1551.7565 3283.9679 11387.0296  
## [2,] 29390.600 44405.556 20819.836 55876.947 -2344.5119 4961.6686 17204.3909  
## [3,] 13779.976 20819.836 9761.517 26198.273 -1099.2398 2326.3108 8066.3915  
## [4,] 36983.143 55876.947 26198.273 70311.771 -2950.1751 6243.4281 21648.8417  
## [5,] -1551.757 -2344.512 -1099.240 -2950.175 123.7849 -261.9648 -908.3525  
## [6,] 3283.968 4961.669 2326.311 6243.428 -261.9648 554.3936 1922.3380  
## [7,] 11387.030 17204.391 8066.391 21648.842 -908.3525 1922.3380 6665.6314  
## [8,] 24873.417 37580.652 17619.935 47288.950 -1984.1725 4199.0858 14560.1652  
## [9,] 17216.283 26011.670 12195.742 32731.326 -1373.3567 2906.4221 10077.9044  
## [10,] 45585.776 68874.460 32292.242 86666.961 -3636.4141 7695.7092 26684.5695  
## [11,] 44715.827 67560.075 31675.984 85013.028 -3567.0176 7548.8460 26175.3271  
## [12,] 29721.669 44905.759 21054.359 56506.369 -2370.9214 5017.5589 17398.1885  
## [,8] [,9] [,10] [,11] [,12]  
## [1,] 24873.417 17216.283 45585.776 44715.827 29721.669  
## [2,] 37580.652 26011.670 68874.460 67560.075 44905.759  
## [3,] 17619.935 12195.742 32292.242 31675.984 21054.359  
## [4,] 47288.950 32731.326 86666.961 85013.028 56506.369  
## [5,] -1984.173 -1373.357 -3636.414 -3567.018 -2370.921  
## [6,] 4199.086 2906.422 7695.709 7548.846 5017.559  
## [7,] 14560.165 10077.904 26684.569 26175.327 17398.189  
## [8,] 31804.700 22013.811 58288.812 57176.442 38003.976  
## [9,] 22013.811 15236.990 40344.946 39575.012 26304.677  
## [10,] 58288.812 40344.946 106826.526 104787.872 69650.291  
## [11,] 57176.442 39575.012 104787.872 102788.124 68321.101  
## [12,] 38003.976 26304.677 69650.291 68321.101 45411.596  
##   
## Multivariate Tests: gender  
## Df test stat approx F num Df den Df Pr(>F)   
## Pillai 1 0.5958337 245.2134 12 1996 < 2.22e-16 \*\*\*  
## Wilks 1 0.4041663 245.2134 12 1996 < 2.22e-16 \*\*\*  
## Hotelling-Lawley 1 1.4742290 245.2134 12 1996 < 2.22e-16 \*\*\*  
## Roy 1 1.4742290 245.2134 12 1996 < 2.22e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## ------------------------------------------  
##   
## Term: race\_eth   
##   
## Sum of squares and products for the hypothesis:  
## [,1] [,2] [,3] [,4] [,5] [,6]  
## [1,] 692.47251 1607.1600 1191.128 1730.941 806.1246 -97.23689  
## [2,] 1607.15998 3751.9874 2979.024 4153.205 1921.7970 -290.77736  
## [3,] 1191.12824 2979.0243 8369.233 7359.854 4450.4094 -2774.69306  
## [4,] 1730.94088 4153.2046 7359.854 7714.465 4152.4422 -1940.52220  
## [5,] 806.12464 1921.7970 4450.409 4152.442 2619.7198 -1475.15280  
## [6,] -97.23689 -290.7774 -2774.693 -1940.522 -1475.1528 1177.63800  
## [7,] -174.07796 -483.9916 -3268.196 -2642.975 -1704.0964 1231.54518  
## [8,] 1703.44061 3996.7169 4778.276 5685.374 2936.9164 -982.90410  
## [9,] 2506.31050 6052.5262 13302.515 12792.567 7505.4188 -4082.40859  
## [10,] 1760.25746 4221.4845 7574.907 7885.628 4287.8725 -2029.24559  
## [11,] 2084.92143 5065.6108 12487.882 11901.756 6970.6682 -3910.29367  
## [12,] 485.55065 1233.5927 4720.498 3876.267 2545.4194 -1732.13732  
## [,7] [,8] [,9] [,10] [,11] [,12]  
## [1,] -174.0780 1703.4406 2506.311 1760.257 2084.921 485.5507  
## [2,] -483.9916 3996.7169 6052.526 4221.485 5065.611 1233.5927  
## [3,] -3268.1957 4778.2760 13302.515 7574.907 12487.882 4720.4980  
## [4,] -2642.9752 5685.3739 12792.567 7885.628 11901.756 3876.2670  
## [5,] -1704.0964 2936.9164 7505.419 4287.873 6970.668 2545.4194  
## [6,] 1231.5452 -982.9041 -4082.409 -2029.246 -3910.294 -1732.1373  
## [7,] 1518.6131 -1374.0060 -5042.220 -2727.126 -4987.671 -1962.0069  
## [8,] -1374.0060 4805.8825 8975.760 5804.769 8004.428 2343.7170  
## [9,] -5042.2204 8975.7601 22352.214 13143.870 20878.020 7367.4994  
## [10,] -2727.1257 5804.7695 13143.870 8065.576 12221.378 4010.5586  
## [11,] -4987.6710 8004.4277 20878.020 12221.378 19806.728 6992.0333  
## [12,] -1962.0069 2343.7170 7367.499 4010.559 6992.033 2780.7417  
##   
## Multivariate Tests: race\_eth  
## Df test stat approx F num Df den Df Pr(>F)   
## Pillai 4 0.4302444 20.07744 48 7996.000 < 2.22e-16 \*\*\*  
## Wilks 4 0.6022428 22.54356 48 7690.839 < 2.22e-16 \*\*\*  
## Hotelling-Lawley 4 0.6073404 25.23626 48 7978.000 < 2.22e-16 \*\*\*  
## Roy 4 0.5074336 84.52999 12 1999.000 < 2.22e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## ------------------------------------------  
##   
## Term: age\_group   
##   
## Sum of squares and products for the hypothesis:  
## [,1] [,2] [,3] [,4] [,5] [,6]  
## [1,] 2288.4449 -412.22143 -867.43834 7682.677 -534.20355 930.53301  
## [2,] -412.2214 581.97161 571.01726 -1070.419 126.68368 -117.38590  
## [3,] -867.4383 571.01726 667.63253 -2656.046 227.37128 -311.68392  
## [4,] 7682.6772 -1070.41881 -2656.04631 25985.527 -1774.60255 3154.96334  
## [5,] -534.2035 126.68368 227.37128 -1774.603 126.52892 -214.20581  
## [6,] 930.5330 -117.38590 -311.68392 3154.963 -214.20581 383.34549  
## [7,] 742.3135 -96.10558 -250.65182 2515.286 -171.02604 305.56223  
## [8,] 1084.1703 325.30616 14.33146 3961.162 -221.85403 492.35505  
## [9,] -295.4850 563.30184 528.69458 -677.060 99.57475 -69.68495  
## [10,] 6671.5263 -796.72408 -2197.97554 22647.458 -1533.07224 2752.86493  
## [11,] 2002.2829 -755.11054 -1081.19052 6478.453 -491.06449 775.14841  
## [12,] 1029.3607 -332.54730 -510.37138 3364.890 -249.11477 404.00470  
## [,7] [,8] [,9] [,10] [,11] [,12]  
## [1,] 742.31350 1084.17031 -295.48502 6671.5263 2002.2829 1029.3607  
## [2,] -96.10558 325.30616 563.30184 -796.7241 -755.1105 -332.5473  
## [3,] -250.65182 14.33146 528.69458 -2197.9755 -1081.1905 -510.3714  
## [4,] 2515.28596 3961.16227 -677.05995 22647.4583 6478.4530 3364.8902  
## [5,] -171.02604 -221.85403 99.57475 -1533.0722 -491.0645 -249.1148  
## [6,] 305.56223 492.35505 -69.68495 2752.8649 775.1484 404.0047  
## [7,] 243.57349 390.24018 -58.06457 2194.0760 620.2724 323.0003  
## [8,] 390.24018 1047.44346 383.02901 3575.9983 544.1548 336.8086  
## [9,] -58.06457 383.02901 550.59789 -454.5201 -654.8036 -280.7217  
## [10,] 2194.07603 3575.99828 -454.52005 19772.6770 5522.6161 2883.5358  
## [11,] 620.27242 544.15483 -654.80361 5522.6161 2058.3342 1014.9428  
## [12,] 323.00026 336.80860 -280.72169 2883.5358 1014.9428 505.6492  
##   
## Multivariate Tests: age\_group  
## Df test stat approx F num Df den Df Pr(>F)   
## Pillai 2 0.1518561 13.67393 24 3994 < 2.22e-16 \*\*\*  
## Wilks 2 0.8498848 14.09273 24 3992 < 2.22e-16 \*\*\*  
## Hotelling-Lawley 2 0.1745818 14.51211 24 3990 < 2.22e-16 \*\*\*  
## Roy 2 0.1619325 26.94826 12 1997 < 2.22e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

#<https://www.sagepub.com/sites/default/files/upm-assets/9761_book_item_9761.pdf> Type I, hierarchical or sequential sums of squares, is appropriate when the groups in the MANOVA are of equal sizes. Type I sum of squares provides a breakdown of the sums of squares for the whole model used in the MANOVA but it is particularly sensitive to the order in which the independent variables are placed in the model. If a variable is entered first, it is not adjusted for any of the other variables; if it is entered second, it is adjusted for one other variable (the first one entered); if it is placed third, it will be adjusted for the two other variables already entered.

output1<-manova(variables ~ gender+race\_eth+age\_group, data=chosen\_imputed1)  
  
#type 3 and type 1 give same Pillai values  
  
summary(output1)

## Df Pillai approx F num Df den Df Pr(>F)   
## gender 1 0.59092 240.268 12 1996 < 2.2e-16 \*\*\*  
## race\_eth 4 0.43402 20.275 48 7996 < 2.2e-16 \*\*\*  
## age\_group 2 0.15186 13.674 24 3994 < 2.2e-16 \*\*\*  
## Residuals 2007   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

output2<-as.data.frame(tidy(output1))  
output2$signif <- with(output2, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
output2$p.value <- formatC(output2$p.value, format = "e")  
  
output2 <- rename(output2, f.statistic = statistic)  
  
#Autofit Width Table TNR  
flextable(output2) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Additive MANOVA Model Findings (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Additive MANOVA Model Findings (Imputed Data)

| **term** | **df** | **pillai** | **f.statistic** | **num.df** | **den.df** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| gender | 1 | 0.5909175 | 240.26762 | 12 | 1,996 | 0.0000e+00 | TRUE |
| race\_eth | 4 | 0.4340167 | 20.27490 | 48 | 7,996 | 7.4655e-162 | TRUE |
| age\_group | 2 | 0.1518561 | 13.67393 | 24 | 3,994 | 8.8336e-53 | TRUE |
| Residuals | 2,007 |  |  |  |  | NA |  |

From 511 notes:

The experimentwise error rate (EER) is the probability of having at least one false rejection in the group of tests from a single experiment or study. The “experiment” is the ANOVA analysis.

John Tukey proposed a method that can be used to run all pairwise comparisons while controlling EER.

Tukey ME > Unadj ME, hence we will find evidence of fewer differences (or weaker evidence of differences) using Tukey’s method.

AA\_Cout <- aov(AA\_C ~ gender+race\_eth+age\_group, data=chosen\_imputed1)  
summary(AA\_Cout)

## Df Sum Sq Mean Sq F value Pr(>F)   
## gender 1 18700 18700 684.94 < 2e-16 \*\*\*  
## race\_eth 4 839 210 7.68 3.87e-06 \*\*\*  
## age\_group 2 2288 1144 41.91 < 2e-16 \*\*\*  
## Residuals 2007 54793 27   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 1 observation deleted due to missingness

AA\_Cout\_data <- as.data.frame(tidy(AA\_Cout))

AA\_Cout\_data <- rename(AA\_Cout\_data, f.statistic = statistic)  
AA\_Cout\_data$signif <- with(AA\_Cout\_data, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
AA\_Cout\_data$p.value <- formatC(AA\_Cout\_data$p.value, format = "e")  
  
  
  
AA\_Cout\_data <- AA\_Cout\_data %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
#Autofit Width Table TNR  
flextable(AA\_Cout\_data) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("AA\_C Additive Anova Model Findings (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : AA\_C Additive Anova Model Findings (Imputed Data)

| **term** | **df** | **sumsq** | **meansq** | **f.statistic** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| gender | 1 | 18,699.680 | 18,699.680 | 684.941 | 3.8253e-130 | TRUE |
| race\_eth | 4 | 838.646 | 209.662 | 7.680 | 3.8699e-06 | TRUE |
| age\_group | 2 | 2,288.445 | 1,144.222 | 41.911 | 1.4725e-18 | TRUE |
| Residuals | 2,007 | 54,793.395 | 27.301 |  | NA |  |

AA\_Cg\_em <- emmeans(AA\_Cout, ~ gender)  
AA\_Cg\_em1 <- as.data.frame(AA\_Cg\_em)  
  
AA\_Cg\_em

## gender emmean SE df lower.CL upper.CL  
## Female/Other 58.5 0.311 2007 57.9 59.1  
## Male 64.7 0.307 2007 64.1 65.3  
##   
## Results are averaged over the levels of: race\_eth, age\_group   
## Confidence level used: 0.95

AA\_Cg\_em1<- AA\_Cg\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(AA\_Cg\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: AA\_C and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: AA\_C and Gender (Imputed Data)

| **gender** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Female/Other | 58.460 | 0.311 | 2,007 | 57.851 | 59.069 |
| Male | 64.719 | 0.307 | 2,007 | 64.117 | 65.321 |

AA\_Cg\_em2 <- pairs(AA\_Cg\_em, adjust="Tukey")  
AA\_Cg\_em3 <- as.data.frame(AA\_Cg\_em2)  
  
AA\_Cg\_em3$signif <- with(AA\_Cg\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
AA\_Cg\_em3$p.value <- formatC(AA\_Cg\_em3$p.value, format = "e")  
  
AA\_Cg\_em2

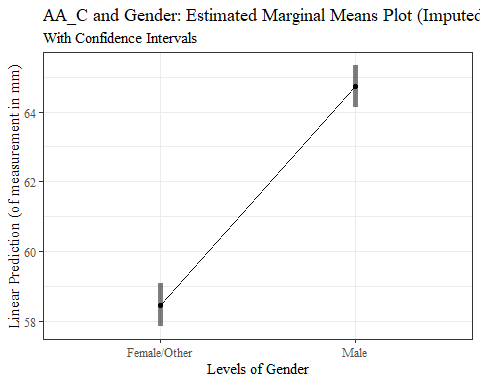
## contrast estimate SE df t.ratio p.value  
## (Female/Other) - Male -6.26 0.234 2007 -26.693 <.0001  
##   
## Results are averaged over the levels of: race\_eth, age\_group

AA\_Cg\_em3<- AA\_Cg\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(AA\_Cg\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: AA\_C and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: AA\_C and Gender (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (Female/Other) - Male | -6.259 | 0.234 | 2,007 | -26.693 | 1.3605e-134 | TRUE |

emmip\_AA\_Cg <- emmip(AA\_Cout, ~ gender, CIs = TRUE)  
  
emmip\_AA\_Cg +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="AA\_C and Gender: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Gender")



AA\_Cr\_em <- emmeans(AA\_Cout, ~ race\_eth)  
AA\_Cr\_em1 <- as.data.frame(AA\_Cr\_em)  
  
AA\_Cr\_em

## race\_eth emmean SE df lower.CL upper.CL  
## Asian 59.6 0.576 2007 58.5 60.7  
## Black 62.6 0.281 2007 62.0 63.1  
## LatinX 62.2 0.552 2007 61.1 63.2  
## Other 61.6 0.858 2007 60.0 63.3  
## white 62.0 0.226 2007 61.6 62.4  
##   
## Results are averaged over the levels of: gender, age\_group   
## Confidence level used: 0.95

AA\_Cr\_em1<- AA\_Cr\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(AA\_Cr\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: AA\_C and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: AA\_C and Race/Ethnicity (Imputed Data)

| **race\_eth** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Asian | 59.601 | 0.576 | 2,007 | 58.472 | 60.731 |
| Black | 62.554 | 0.281 | 2,007 | 62.003 | 63.104 |
| LatinX | 62.152 | 0.552 | 2,007 | 61.069 | 63.235 |
| Other | 61.642 | 0.858 | 2,007 | 59.959 | 63.325 |
| white | 61.999 | 0.226 | 2,007 | 61.555 | 62.443 |

AA\_Cr\_em2 <- pairs(AA\_Cr\_em, adjust="Tukey")  
AA\_Cr\_em3 <- as.data.frame(AA\_Cr\_em2)  
  
AA\_Cr\_em3$signif <- with(AA\_Cr\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
AA\_Cr\_em3$p.value <- formatC(AA\_Cr\_em3$p.value, format = "e")  
  
  
  
AA\_Cr\_em2

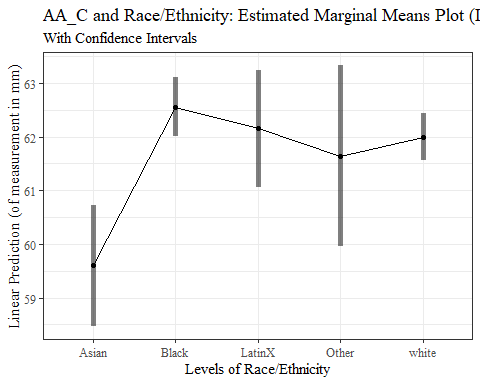
## contrast estimate SE df t.ratio p.value  
## Asian - Black -2.952 0.593 2007 -4.982 <.0001  
## Asian - LatinX -2.551 0.759 2007 -3.361 0.0071  
## Asian - Other -2.041 1.010 2007 -2.020 0.2565  
## Asian - white -2.397 0.568 2007 -4.219 0.0002  
## Black - LatinX 0.402 0.571 2007 0.703 0.9558  
## Black - Other 0.911 0.878 2007 1.038 0.8376  
## Black - white 0.555 0.268 2007 2.067 0.2351  
## LatinX - Other 0.510 0.998 2007 0.511 0.9863  
## LatinX - white 0.153 0.546 2007 0.280 0.9986  
## Other - white -0.356 0.862 2007 -0.414 0.9939  
##   
## Results are averaged over the levels of: gender, age\_group   
## P value adjustment: tukey method for comparing a family of 5 estimates

AA\_Cr\_em3<- AA\_Cr\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(AA\_Cr\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: AA\_C and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: AA\_C and Race/Ethnicity (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| Asian - Black | -2.952 | 0.593 | 2,007 | -4.982 | 6.7530e-06 | TRUE |
| Asian - LatinX | -2.551 | 0.759 | 2,007 | -3.361 | 7.0804e-03 | TRUE |
| Asian - Other | -2.041 | 1.010 | 2,007 | -2.020 | 2.5647e-01 | FALSE |
| Asian - white | -2.397 | 0.568 | 2,007 | -4.219 | 2.4797e-04 | TRUE |
| Black - LatinX | 0.402 | 0.571 | 2,007 | 0.703 | 9.5578e-01 | FALSE |
| Black - Other | 0.911 | 0.878 | 2,007 | 1.038 | 8.3758e-01 | FALSE |
| Black - white | 0.555 | 0.268 | 2,007 | 2.067 | 2.3506e-01 | FALSE |
| LatinX - Other | 0.510 | 0.998 | 2,007 | 0.511 | 9.8633e-01 | FALSE |
| LatinX - white | 0.153 | 0.546 | 2,007 | 0.280 | 9.9865e-01 | FALSE |
| Other - white | -0.356 | 0.862 | 2,007 | -0.414 | 9.9386e-01 | FALSE |

emmip\_AA\_Cr <- emmip(AA\_Cout, ~ race\_eth, CIs = TRUE)  
  
emmip\_AA\_Cr +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="AA\_C and Race/Ethnicity: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Race/Ethnicity")



AA\_Ca\_em <- emmeans(AA\_Cout, ~ age\_group)  
AA\_Ca\_em1 <- as.data.frame(AA\_Ca\_em)  
  
AA\_Ca\_em

## age\_group emmean SE df lower.CL upper.CL  
## 18-36 59.9 0.259 2007 59.4 60.4  
## 37-54 61.9 0.270 2007 61.4 62.5  
## 55-72 62.9 0.600 2007 61.7 64.1  
##   
## Results are averaged over the levels of: gender, race\_eth   
## Confidence level used: 0.95

AA\_Ca\_em1<- AA\_Ca\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(AA\_Ca\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: AA\_C and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: AA\_C and Age Group (Imputed Data)

| **age\_group** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| 18-36 | 59.911 | 0.259 | 2,007 | 59.402 | 60.420 |
| 37-54 | 61.934 | 0.270 | 2,007 | 61.405 | 62.463 |
| 55-72 | 62.924 | 0.600 | 2,007 | 61.746 | 64.101 |

AA\_Ca\_em2 <- pairs(AA\_Ca\_em, adjust="Tukey")  
AA\_Ca\_em3 <- as.data.frame(AA\_Ca\_em2)  
  
AA\_Ca\_em3$signif <- with(AA\_Ca\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
AA\_Ca\_em3$p.value <- formatC(AA\_Ca\_em3$p.value, format = "e")  
  
AA\_Ca\_em2

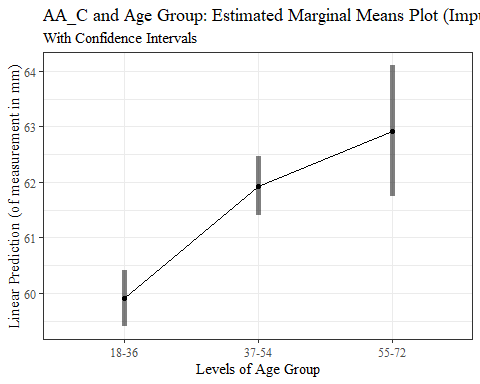
## contrast estimate SE df t.ratio p.value  
## (18-36) - (37-54) -2.023 0.239 2007 -8.458 <.0001  
## (18-36) - (55-72) -3.012 0.595 2007 -5.067 <.0001  
## (37-54) - (55-72) -0.989 0.597 2007 -1.658 0.2217  
##   
## Results are averaged over the levels of: gender, race\_eth   
## P value adjustment: tukey method for comparing a family of 3 estimates

AA\_Ca\_em3<- AA\_Ca\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(AA\_Ca\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: AA\_C and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: AA\_C and Age Group (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (18-36) - (37-54) | -2.023 | 0.239 | 2,007 | -8.458 | 4.6513e-11 | TRUE |
| (18-36) - (55-72) | -3.012 | 0.595 | 2,007 | -5.067 | 1.3204e-06 | TRUE |
| (37-54) - (55-72) | -0.989 | 0.597 | 2,007 | -1.658 | 2.2174e-01 | FALSE |

emmip\_AA\_Ca <- emmip(AA\_Cout, ~ age\_group, CIs = TRUE)  
  
emmip\_AA\_Ca +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="AA\_C and Age Group: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Age Group")



BiW\_Lout <- aov(BiW\_L ~ gender+race\_eth+age\_group, data=chosen\_imputed1)  
summary(BiW\_Lout)

## Df Sum Sq Mean Sq F value Pr(>F)   
## gender 1 10160 10160 120.647 <2e-16 \*\*\*  
## race\_eth 4 8302 2076 24.647 <2e-16 \*\*\*  
## age\_group 2 668 334 3.964 0.0191 \*   
## Residuals 2007 169009 84   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 1 observation deleted due to missingness

BiW\_Lout\_data <- as.data.frame(tidy(BiW\_Lout))

BiW\_Lout\_data <- rename(BiW\_Lout\_data, f.statistic = statistic)  
BiW\_Lout\_data$signif <- with(BiW\_Lout\_data, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
BiW\_Lout\_data$p.value <- formatC(BiW\_Lout\_data$p.value, format = "e")  
  
BiW\_Lout\_data <- BiW\_Lout\_data %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
#Autofit Width Table TNR  
flextable(BiW\_Lout\_data) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("BiW\_L Additive Anova Model Findings") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : BiW\_L Additive Anova Model Findings

| **term** | **df** | **sumsq** | **meansq** | **f.statistic** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| gender | 1 | 10,159.706 | 10,159.706 | 120.647 | 2.6870e-27 | TRUE |
| race\_eth | 4 | 8,302.172 | 2,075.543 | 24.647 | 6.0533e-20 | TRUE |
| age\_group | 2 | 667.633 | 333.816 | 3.964 | 1.9134e-02 | TRUE |
| Residuals | 2,007 | 169,009.311 | 84.210 |  | NA |  |

BiW\_Lg\_em <- emmeans(BiW\_Lout, ~ gender)  
BiW\_Lg\_em1 <- as.data.frame(BiW\_Lg\_em)  
  
BiW\_Lg\_em

## gender emmean SE df lower.CL upper.CL  
## Female/Other 108 0.546 2007 107 109  
## Male 113 0.539 2007 112 114  
##   
## Results are averaged over the levels of: race\_eth, age\_group   
## Confidence level used: 0.95

BiW\_Lg\_em1 <- BiW\_Lg\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(BiW\_Lg\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: BiW\_L and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: BiW\_L and Gender (Imputed Data)

| **gender** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Female/Other | 108.381 | 0.546 | 2,007 | 107.311 | 109.451 |
| Male | 112.815 | 0.539 | 2,007 | 111.758 | 113.873 |

BiW\_Lg\_em2 <- pairs(BiW\_Lg\_em, adjust="Tukey")  
BiW\_Lg\_em3 <- as.data.frame(BiW\_Lg\_em2)  
  
BiW\_Lg\_em3$signif <- with(BiW\_Lg\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
BiW\_Lg\_em3$p.value <- formatC(BiW\_Lg\_em3$p.value, format = "e")  
  
BiW\_Lg\_em2

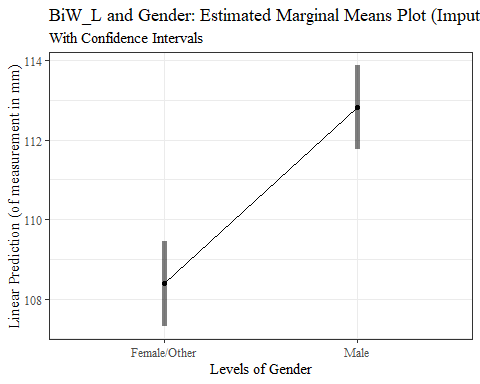
## contrast estimate SE df t.ratio p.value  
## (Female/Other) - Male -4.43 0.412 2007 -10.767 <.0001  
##   
## Results are averaged over the levels of: race\_eth, age\_group

BiW\_Lg\_em3 <- BiW\_Lg\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
  
flextable(BiW\_Lg\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: BiW\_L and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: BiW\_L and Gender (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (Female/Other) - Male | -4.434 | 0.412 | 2,007 | -10.767 | 2.5525e-26 | TRUE |

emmip\_BiW\_Lg <- emmip(BiW\_Lout, ~ gender, CIs = TRUE)  
  
emmip\_BiW\_Lg +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="BiW\_L and Gender: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Gender")



BiW\_Lr\_em <- emmeans(BiW\_Lout, ~ race\_eth)  
BiW\_Lr\_em1 <- as.data.frame(BiW\_Lr\_em)  
  
BiW\_Lr\_em

## race\_eth emmean SE df lower.CL upper.CL  
## Asian 110 1.011 2007 108 112  
## Black 114 0.493 2007 113 115  
## LatinX 111 0.970 2007 109 113  
## Other 109 1.507 2007 106 112  
## white 109 0.398 2007 108 110  
##   
## Results are averaged over the levels of: gender, age\_group   
## Confidence level used: 0.95

BiW\_Lr\_em1 <- BiW\_Lr\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(BiW\_Lr\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: BiW\_L and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: BiW\_L and Race/Ethnicity (Imputed Data)

| **race\_eth** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Asian | 109.750 | 1.011 | 2,007 | 107.767 | 111.733 |
| Black | 113.831 | 0.493 | 2,007 | 112.865 | 114.798 |
| LatinX | 111.037 | 0.970 | 2,007 | 109.134 | 112.939 |
| Other | 109.199 | 1.507 | 2,007 | 106.244 | 112.155 |
| white | 109.174 | 0.398 | 2,007 | 108.394 | 109.954 |

BiW\_Lr\_em2 <- pairs(BiW\_Lr\_em, adjust="Tukey")  
BiW\_Lr\_em3 <- as.data.frame(BiW\_Lr\_em2)  
  
BiW\_Lr\_em3$signif <- with(BiW\_Lr\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
BiW\_Lr\_em3$p.value <- formatC(BiW\_Lr\_em3$p.value, format = "e")  
  
BiW\_Lr\_em2

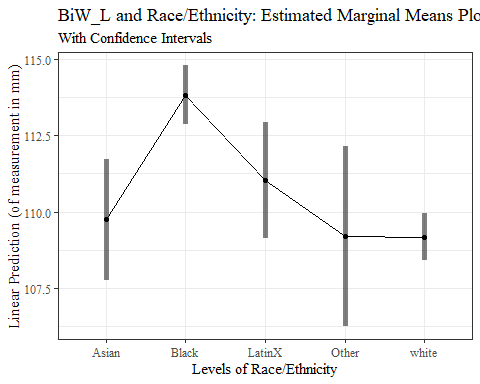
## contrast estimate SE df t.ratio p.value  
## Asian - Black -4.0814 1.041 2007 -3.922 0.0009  
## Asian - LatinX -1.2870 1.333 2007 -0.966 0.8706  
## Asian - Other 0.5504 1.774 2007 0.310 0.9980  
## Asian - white 0.5756 0.998 2007 0.577 0.9785  
## Black - LatinX 2.7945 1.003 2007 2.786 0.0428  
## Black - Other 4.6318 1.541 2007 3.005 0.0226  
## Black - white 4.6570 0.471 2007 9.877 <.0001  
## LatinX - Other 1.8373 1.752 2007 1.048 0.8327  
## LatinX - white 1.8625 0.959 2007 1.942 0.2951  
## Other - white 0.0252 1.513 2007 0.017 1.0000  
##   
## Results are averaged over the levels of: gender, age\_group   
## P value adjustment: tukey method for comparing a family of 5 estimates

BiW\_Lr\_em3 <- BiW\_Lr\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(BiW\_Lr\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: BiW\_L and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: BiW\_L and Race/Ethnicity (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| Asian - Black | -4.081 | 1.041 | 2,007 | -3.922 | 8.6188e-04 | TRUE |
| Asian - LatinX | -1.287 | 1.333 | 2,007 | -0.966 | 8.7061e-01 | FALSE |
| Asian - Other | 0.550 | 1.774 | 2,007 | 0.310 | 9.9799e-01 | FALSE |
| Asian - white | 0.576 | 0.998 | 2,007 | 0.577 | 9.7848e-01 | FALSE |
| Black - LatinX | 2.794 | 1.003 | 2,007 | 2.786 | 4.2843e-02 | TRUE |
| Black - Other | 4.632 | 1.541 | 2,007 | 3.005 | 2.2566e-02 | TRUE |
| Black - white | 4.657 | 0.471 | 2,007 | 9.877 | 4.6531e-11 | TRUE |
| LatinX - Other | 1.837 | 1.752 | 2,007 | 1.048 | 8.3266e-01 | FALSE |
| LatinX - white | 1.863 | 0.959 | 2,007 | 1.942 | 2.9515e-01 | FALSE |
| Other - white | 0.025 | 1.513 | 2,007 | 0.017 | 1.0000e+00 | FALSE |

emmip\_BiW\_Lr <- emmip(BiW\_Lout, ~ race\_eth, CIs = TRUE)  
  
emmip\_BiW\_Lr +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="BiW\_L and Race/Ethnicity: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Race/Ethnicity")



BiW\_La\_em <- emmeans(BiW\_Lout, ~ age\_group)  
BiW\_La\_em1 <- as.data.frame(BiW\_La\_em)  
  
BiW\_La\_em

## age\_group emmean SE df lower.CL upper.CL  
## 18-36 112 0.456 2007 111 113  
## 37-54 111 0.474 2007 110 112  
## 55-72 109 1.054 2007 107 111  
##   
## Results are averaged over the levels of: gender, race\_eth   
## Confidence level used: 0.95

BiW\_La\_em1 <- BiW\_La\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(BiW\_La\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: BiW\_L and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: BiW\_L and Age Group (Imputed Data)

| **age\_group** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| 18-36 | 111.709 | 0.456 | 2,007 | 110.815 | 112.602 |
| 37-54 | 111.264 | 0.474 | 2,007 | 110.335 | 112.193 |
| 55-72 | 108.822 | 1.054 | 2,007 | 106.754 | 110.890 |

BiW\_La\_em2 <- pairs(BiW\_La\_em, adjust="Tukey")  
BiW\_La\_em3 <- as.data.frame(BiW\_La\_em2)  
  
BiW\_La\_em3$signif <- with(BiW\_La\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
BiW\_La\_em3$p.value <- formatC(BiW\_La\_em3$p.value, format = "e")  
  
BiW\_La\_em2

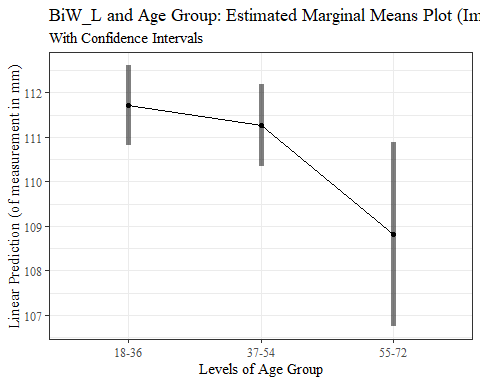
## contrast estimate SE df t.ratio p.value  
## (18-36) - (37-54) 0.444 0.42 2007 1.058 0.5404  
## (18-36) - (55-72) 2.886 1.04 2007 2.764 0.0159  
## (37-54) - (55-72) 2.442 1.05 2007 2.331 0.0519  
##   
## Results are averaged over the levels of: gender, race\_eth   
## P value adjustment: tukey method for comparing a family of 3 estimates

BiW\_La\_em3 <- BiW\_La\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(BiW\_La\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: BiW\_L and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: BiW\_L and Age Group (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (18-36) - (37-54) | 0.444 | 0.420 | 2,007 | 1.058 | 5.4041e-01 | FALSE |
| (18-36) - (55-72) | 2.886 | 1.044 | 2,007 | 2.764 | 1.5873e-02 | TRUE |
| (37-54) - (55-72) | 2.442 | 1.048 | 2,007 | 2.331 | 5.1904e-02 | FALSE |

emmip\_BiW\_La <- emmip(BiW\_Lout, ~ age\_group, CIs = TRUE)  
  
emmip\_BiW\_La +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="BiW\_L and Age Group: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Age Group")



BiW\_Cout <- aov(BiW\_C ~ gender+race\_eth+age\_group, data=chosen\_imputed1)  
summary(BiW\_Cout)

## Df Sum Sq Mean Sq F value Pr(>F)   
## gender 1 43814 43814 317.027 < 2e-16 \*\*\*  
## race\_eth 4 3760 940 6.802 1.95e-05 \*\*\*  
## age\_group 2 582 291 2.106 0.122   
## Residuals 2007 277372 138   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 1 observation deleted due to missingness

BiW\_Cout\_data <- as.data.frame(tidy(BiW\_Cout))

BiW\_Cout\_data <- rename(BiW\_Cout\_data, f.statistic = statistic)  
BiW\_Cout\_data$signif <- with(BiW\_Cout\_data, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
BiW\_Cout\_data$p.value <- formatC(BiW\_Cout\_data$p.value, format = "e")  
  
  
BiW\_Cout\_data <- BiW\_Cout\_data %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
#Autofit Width Table TNR  
flextable(BiW\_Cout\_data) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("BiW\_C Additive Anova Model Findings (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : BiW\_C Additive Anova Model Findings (Imputed Data)

| **term** | **df** | **sumsq** | **meansq** | **f.statistic** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| gender | 1 | 43,813.790 | 43,813.790 | 317.027 | 5.8232e-66 | TRUE |
| race\_eth | 4 | 3,760.349 | 940.087 | 6.802 | 1.9515e-05 | TRUE |
| age\_group | 2 | 581.972 | 290.986 | 2.106 | 1.2205e-01 | FALSE |
| Residuals | 2,007 | 277,371.858 | 138.202 |  | NA |  |

BiW\_Cg\_em <- emmeans(BiW\_Cout, ~ gender)  
BiW\_Cg\_em1 <- as.data.frame(BiW\_Cg\_em)  
  
BiW\_Cg\_em

## gender emmean SE df lower.CL upper.CL  
## Female/Other 127 0.699 2007 126 128  
## Male 137 0.691 2007 135 138  
##   
## Results are averaged over the levels of: race\_eth, age\_group   
## Confidence level used: 0.95

BiW\_Cg\_em1 <- BiW\_Cg\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(BiW\_Cg\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: BiW\_C and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: BiW\_C and Gender (Imputed Data)

| **gender** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Female/Other | 127.123 | 0.699 | 2,007 | 125.753 | 128.494 |
| Male | 136.580 | 0.691 | 2,007 | 135.225 | 137.935 |

BiW\_Cg\_em2 <- pairs(BiW\_Cg\_em, adjust="Tukey")  
BiW\_Cg\_em3 <- as.data.frame(BiW\_Cg\_em2)  
  
BiW\_Cg\_em3$signif <- with(BiW\_Cg\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
BiW\_Cg\_em3$p.value <- formatC(BiW\_Cg\_em3$p.value, format = "e")  
  
BiW\_Cg\_em2

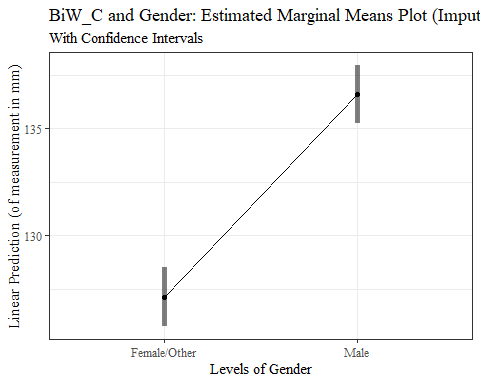
## contrast estimate SE df t.ratio p.value  
## (Female/Other) - Male -9.46 0.528 2007 -17.925 <.0001  
##   
## Results are averaged over the levels of: race\_eth, age\_group

BiW\_Cg\_em3 <- BiW\_Cg\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(BiW\_Cg\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: BiW\_C and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: BiW\_C and Gender (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (Female/Other) - Male | -9.457 | 0.528 | 2,007 | -17.925 | 9.1294e-67 | TRUE |

emmip\_BiW\_Cg <- emmip(BiW\_Cout, ~ gender, CIs = TRUE)  
  
emmip\_BiW\_Cg +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="BiW\_C and Gender: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Gender")



BiW\_Cr\_em <- emmeans(BiW\_Cout, ~ race\_eth)  
BiW\_Cr\_em1 <- as.data.frame(BiW\_Cr\_em)  
  
BiW\_Cr\_em

## race\_eth emmean SE df lower.CL upper.CL  
## Asian 127 1.295 2007 125 130  
## Black 134 0.631 2007 133 135  
## LatinX 133 1.243 2007 131 136  
## Other 131 1.931 2007 128 135  
## white 133 0.509 2007 132 134  
##   
## Results are averaged over the levels of: gender, age\_group   
## Confidence level used: 0.95

BiW\_Cr\_em1 <- BiW\_Cr\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
  
flextable(BiW\_Cr\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: BiW\_C and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: BiW\_C and Race/Ethnicity (Imputed Data)

| **race\_eth** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Asian | 127.408 | 1.295 | 2,007 | 124.867 | 129.948 |
| Black | 134.185 | 0.631 | 2,007 | 132.947 | 135.423 |
| LatinX | 133.408 | 1.243 | 2,007 | 130.970 | 135.845 |
| Other | 131.467 | 1.931 | 2,007 | 127.680 | 135.254 |
| white | 132.791 | 0.509 | 2,007 | 131.792 | 133.790 |

BiW\_Cr\_em2 <- pairs(BiW\_Cr\_em, adjust="Tukey")  
BiW\_Cr\_em3 <- as.data.frame(BiW\_Cr\_em2)  
  
BiW\_Cr\_em3$signif <- with(BiW\_Cr\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
BiW\_Cr\_em3$p.value <- formatC(BiW\_Cr\_em3$p.value, format = "e")  
  
BiW\_Cr\_em2

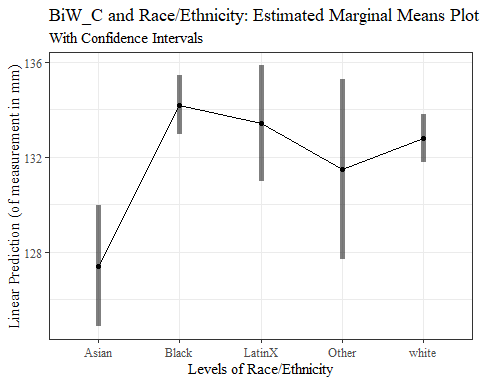
## contrast estimate SE df t.ratio p.value  
## Asian - Black -6.777 1.333 2007 -5.084 <.0001  
## Asian - LatinX -6.000 1.708 2007 -3.514 0.0041  
## Asian - Other -4.059 2.273 2007 -1.786 0.3820  
## Asian - white -5.383 1.278 2007 -4.211 0.0003  
## Black - LatinX 0.777 1.285 2007 0.605 0.9744  
## Black - Other 2.718 1.975 2007 1.376 0.6430  
## Black - white 1.394 0.604 2007 2.308 0.1428  
## LatinX - Other 1.941 2.245 2007 0.864 0.9099  
## LatinX - white 0.617 1.228 2007 0.502 0.9872  
## Other - white -1.324 1.938 2007 -0.683 0.9601  
##   
## Results are averaged over the levels of: gender, age\_group   
## P value adjustment: tukey method for comparing a family of 5 estimates

BiW\_Cr\_em3 <- BiW\_Cr\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(BiW\_Cr\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: BiW\_C and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: BiW\_C and Race/Ethnicity (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| Asian - Black | -6.777 | 1.333 | 2,007 | -5.084 | 4.0133e-06 | TRUE |
| Asian - LatinX | -6.000 | 1.708 | 2,007 | -3.514 | 4.1198e-03 | TRUE |
| Asian - Other | -4.059 | 2.273 | 2,007 | -1.786 | 3.8195e-01 | FALSE |
| Asian - white | -5.383 | 1.278 | 2,007 | -4.211 | 2.5696e-04 | TRUE |
| Black - LatinX | 0.777 | 1.285 | 2,007 | 0.605 | 9.7436e-01 | FALSE |
| Black - Other | 2.718 | 1.975 | 2,007 | 1.376 | 6.4300e-01 | FALSE |
| Black - white | 1.394 | 0.604 | 2,007 | 2.308 | 1.4280e-01 | FALSE |
| LatinX - Other | 1.941 | 2.245 | 2,007 | 0.864 | 9.0985e-01 | FALSE |
| LatinX - white | 0.617 | 1.228 | 2,007 | 0.502 | 9.8719e-01 | FALSE |
| Other - white | -1.324 | 1.938 | 2,007 | -0.683 | 9.6015e-01 | FALSE |

emmip\_BiW\_Cr <- emmip(BiW\_Cout, ~ race\_eth, CIs = TRUE)  
  
emmip\_BiW\_Cr +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="BiW\_C and Race/Ethnicity: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Race/Ethnicity")



GoSub\_Cout <- aov(GoSub\_C ~ gender+race\_eth+age\_group, data=chosen\_imputed1)  
summary(GoSub\_Cout)

## Df Sum Sq Mean Sq F value Pr(>F)   
## gender 1 65671 65671 401.60 < 2e-16 \*\*\*  
## race\_eth 4 9650 2413 14.75 6.95e-12 \*\*\*  
## age\_group 2 25986 12993 79.45 < 2e-16 \*\*\*  
## Residuals 2007 328192 164   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 1 observation deleted due to missingness

GoSub\_Cout\_data <- as.data.frame(tidy(GoSub\_Cout))

GoSub\_Cout\_data <- rename(GoSub\_Cout\_data, f.statistic = statistic)  
GoSub\_Cout\_data$signif <- with(GoSub\_Cout\_data, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
GoSub\_Cout\_data$p.value <- formatC(GoSub\_Cout\_data$p.value, format = "e")  
  
  
GoSub\_Cout\_data <- GoSub\_Cout\_data %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
  
#Autofit Width Table TNR  
flextable(GoSub\_Cout\_data) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("GoSub\_C Additive Anova Model Findings (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : GoSub\_C Additive Anova Model Findings (Imputed Data)

| **term** | **df** | **sumsq** | **meansq** | **f.statistic** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| gender | 1 | 65,670.967 | 65,670.967 | 401.599 | 1.3934e-81 | TRUE |
| race\_eth | 4 | 9,650.239 | 2,412.560 | 14.754 | 6.9538e-12 | TRUE |
| age\_group | 2 | 25,985.527 | 12,992.763 | 79.455 | 6.1822e-34 | TRUE |
| Residuals | 2,007 | 328,191.820 | 163.524 |  | NA |  |

GoSub\_Cg\_em <- emmeans(GoSub\_Cout, ~ gender)  
GoSub\_Cg\_em1 <- as.data.frame(GoSub\_Cg\_em)  
  
GoSub\_Cg\_em

## gender emmean SE df lower.CL upper.CL  
## Female/Other 94.2 0.760 2007 92.7 95.7  
## Male 106.1 0.751 2007 104.6 107.6  
##   
## Results are averaged over the levels of: race\_eth, age\_group   
## Confidence level used: 0.95

GoSub\_Cg\_em1 <- GoSub\_Cg\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(GoSub\_Cg\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: GoSub\_C and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: GoSub\_C and Gender (Imputed Data)

| **gender** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Female/Other | 94.198 | 0.760 | 2,007 | 92.707 | 95.689 |
| Male | 106.098 | 0.751 | 2,007 | 104.624 | 107.571 |

GoSub\_Cg\_em2 <- pairs(GoSub\_Cg\_em, adjust="Tukey")  
GoSub\_Cg\_em3 <- as.data.frame(GoSub\_Cg\_em2)  
  
GoSub\_Cg\_em3$signif <- with(GoSub\_Cg\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
GoSub\_Cg\_em3$p.value <- formatC(GoSub\_Cg\_em3$p.value, format = "e")  
  
GoSub\_Cg\_em2

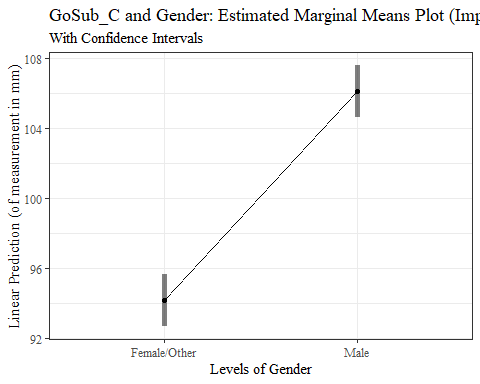
## contrast estimate SE df t.ratio p.value  
## (Female/Other) - Male -11.9 0.574 2007 -20.736 <.0001  
##   
## Results are averaged over the levels of: race\_eth, age\_group

GoSub\_Cg\_em3 <- GoSub\_Cg\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(GoSub\_Cg\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: GoSub\_C and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: GoSub\_C and Gender (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (Female/Other) - Male | -11.9 | 0.574 | 2,007 | -20.736 | 1.0636e-86 | TRUE |

emmip\_GoSub\_Cg <- emmip(GoSub\_Cout, ~ gender, CIs = TRUE)  
  
emmip\_GoSub\_Cg +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="GoSub\_C and Gender: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Gender")



GoSub\_Cr\_em <- emmeans(GoSub\_Cout, ~ race\_eth)  
GoSub\_Cr\_em1 <- as.data.frame(GoSub\_Cr\_em)  
  
GoSub\_Cr\_em

## race\_eth emmean SE df lower.CL upper.CL  
## Asian 97.6 1.409 2007 94.8 100  
## Black 104.3 0.687 2007 102.9 106  
## LatinX 100.0 1.352 2007 97.4 103  
## Other 98.6 2.100 2007 94.5 103  
## white 100.3 0.554 2007 99.2 101  
##   
## Results are averaged over the levels of: gender, age\_group   
## Confidence level used: 0.95

GoSub\_Cr\_em1 <- GoSub\_Cr\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(GoSub\_Cr\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: GoSub\_C and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: GoSub\_C and Race/Ethnicity (Imputed Data)

| **race\_eth** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Asian | 97.572 | 1.409 | 2,007 | 94.808 | 100.335 |
| Black | 104.263 | 0.687 | 2,007 | 102.916 | 105.610 |
| LatinX | 100.008 | 1.352 | 2,007 | 97.357 | 102.660 |
| Other | 98.601 | 2.100 | 2,007 | 94.482 | 102.720 |
| white | 100.296 | 0.554 | 2,007 | 99.210 | 101.383 |

GoSub\_Cr\_em2 <- pairs(GoSub\_Cr\_em, adjust="Tukey")  
GoSub\_Cr\_em3 <- as.data.frame(GoSub\_Cr\_em2)  
  
GoSub\_Cr\_em3$signif <- with(GoSub\_Cr\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
GoSub\_Cr\_em3$p.value <- formatC(GoSub\_Cr\_em3$p.value, format = "e")  
  
GoSub\_Cr\_em2

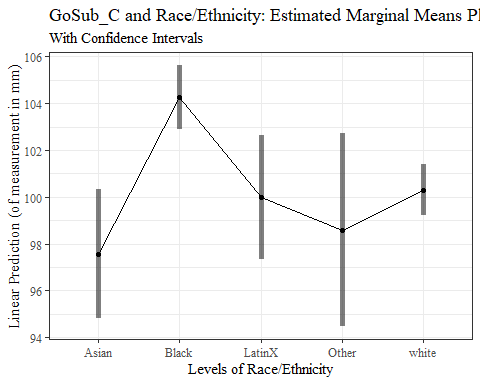
## contrast estimate SE df t.ratio p.value  
## Asian - Black -6.691 1.450 2007 -4.614 <.0001  
## Asian - LatinX -2.437 1.857 2007 -1.312 0.6838  
## Asian - Other -1.030 2.472 2007 -0.416 0.9937  
## Asian - white -2.725 1.391 2007 -1.959 0.2866  
## Black - LatinX 4.255 1.398 2007 3.044 0.0200  
## Black - Other 5.662 2.148 2007 2.636 0.0644  
## Black - white 3.967 0.657 2007 6.038 <.0001  
## LatinX - Other 1.407 2.442 2007 0.576 0.9786  
## LatinX - white -0.288 1.336 2007 -0.215 0.9995  
## Other - white -1.695 2.108 2007 -0.804 0.9295  
##   
## Results are averaged over the levels of: gender, age\_group   
## P value adjustment: tukey method for comparing a family of 5 estimates

GoSub\_Cr\_em3 <- GoSub\_Cr\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
  
flextable(GoSub\_Cr\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: GoSub\_C and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: GoSub\_C and Race/Ethnicity (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| Asian - Black | -6.691 | 1.450 | 2,007 | -4.614 | 4.1194e-05 | TRUE |
| Asian - LatinX | -2.437 | 1.857 | 2,007 | -1.312 | 6.8384e-01 | FALSE |
| Asian - Other | -1.030 | 2.472 | 2,007 | -0.416 | 9.9371e-01 | FALSE |
| Asian - white | -2.725 | 1.391 | 2,007 | -1.959 | 2.8660e-01 | FALSE |
| Black - LatinX | 4.255 | 1.398 | 2,007 | 3.044 | 1.9998e-02 | TRUE |
| Black - Other | 5.662 | 2.148 | 2,007 | 2.636 | 6.4421e-02 | FALSE |
| Black - white | 3.967 | 0.657 | 2,007 | 6.038 | 1.8608e-08 | TRUE |
| LatinX - Other | 1.407 | 2.442 | 2,007 | 0.576 | 9.7855e-01 | FALSE |
| LatinX - white | -0.288 | 1.336 | 2,007 | -0.215 | 9.9952e-01 | FALSE |
| Other - white | -1.695 | 2.108 | 2,007 | -0.804 | 9.2947e-01 | FALSE |

emmip\_GoSub\_Cr <- emmip(GoSub\_Cout, ~ race\_eth, CIs = TRUE)  
  
emmip\_GoSub\_Cr +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="GoSub\_C and Race/Ethnicity: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Race/Ethnicity")



GoSub\_Ca\_em <- emmeans(GoSub\_Cout, ~ age\_group)  
GoSub\_Ca\_em1 <- as.data.frame(GoSub\_Ca\_em)  
  
GoSub\_Ca\_em

## age\_group emmean SE df lower.CL upper.CL  
## 18-36 94.9 0.635 2007 93.6 96.1  
## 37-54 101.9 0.660 2007 100.6 103.2  
## 55-72 103.7 1.469 2007 100.8 106.5  
##   
## Results are averaged over the levels of: gender, race\_eth   
## Confidence level used: 0.95

GoSub\_Ca\_em1 <- GoSub\_Ca\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(GoSub\_Ca\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: GoSub\_C and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: GoSub\_C and Age Group (Imputed Data)

| **age\_group** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| 18-36 | 94.871 | 0.635 | 2,007 | 93.626 | 96.116 |
| 37-54 | 101.907 | 0.660 | 2,007 | 100.613 | 103.201 |
| 55-72 | 103.666 | 1.469 | 2,007 | 100.784 | 106.547 |

GoSub\_Ca\_em2 <- pairs(GoSub\_Ca\_em, adjust="Tukey")  
GoSub\_Ca\_em3 <- as.data.frame(GoSub\_Ca\_em2)  
  
GoSub\_Ca\_em3$signif <- with(GoSub\_Ca\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
GoSub\_Ca\_em3$p.value <- formatC(GoSub\_Ca\_em3$p.value, format = "e")  
  
GoSub\_Ca\_em2

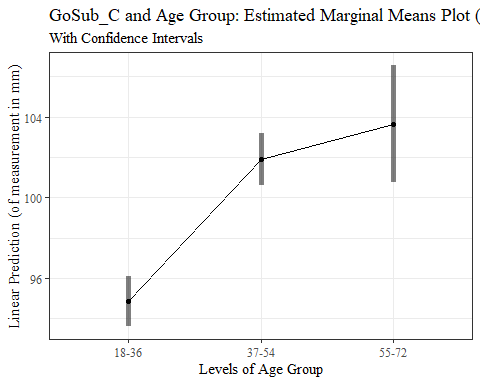
## contrast estimate SE df t.ratio p.value  
## (18-36) - (37-54) -7.04 0.585 2007 -12.019 <.0001  
## (18-36) - (55-72) -8.79 1.455 2007 -6.044 <.0001  
## (37-54) - (55-72) -1.76 1.460 2007 -1.205 0.4505  
##   
## Results are averaged over the levels of: gender, race\_eth   
## P value adjustment: tukey method for comparing a family of 3 estimates

GoSub\_Ca\_em3 <- GoSub\_Ca\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(GoSub\_Ca\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: GoSub\_C and Age Group") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: GoSub\_C and Age Group

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (18-36) - (37-54) | -7.036 | 0.585 | 2,007 | -12.019 | 4.6484e-11 | TRUE |
| (18-36) - (55-72) | -8.795 | 1.455 | 2,007 | -6.044 | 5.3946e-09 | TRUE |
| (37-54) - (55-72) | -1.759 | 1.460 | 2,007 | -1.205 | 4.5053e-01 | FALSE |

emmip\_GoSub\_Ca <- emmip(GoSub\_Cout, ~ age\_group, CIs = TRUE)  
  
emmip\_GoSub\_Ca +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="GoSub\_C and Age Group: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Age Group")



NRB\_Lout <- aov(NRB\_L ~ gender+race\_eth+age\_group, data=chosen\_imputed1)  
summary(NRB\_Lout)

## Df Sum Sq Mean Sq F value Pr(>F)   
## gender 1 100 100.5 4.891 0.0271 \*   
## race\_eth 4 2566 641.5 31.226 <2e-16 \*\*\*  
## age\_group 2 127 63.3 3.079 0.0462 \*   
## Residuals 2007 41232 20.5   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 1 observation deleted due to missingness

NRB\_Lout\_data <- as.data.frame(tidy(NRB\_Lout))

NRB\_Lout\_data <- rename(NRB\_Lout\_data, f.statistic = statistic)  
NRB\_Lout\_data$signif <- with(NRB\_Lout\_data, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
NRB\_Lout\_data$p.value <- formatC(NRB\_Lout\_data$p.value, format = "e")  
  
NRB\_Lout\_data <- NRB\_Lout\_data %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
#Autofit Width Table TNR  
flextable(NRB\_Lout\_data) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("NRB\_L Additive Anova Model Findings (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : NRB\_L Additive Anova Model Findings (Imputed Data)

| **term** | **df** | **sumsq** | **meansq** | **f.statistic** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| gender | 1 | 100.486 | 100.486 | 4.891 | 2.7106e-02 | TRUE |
| race\_eth | 4 | 2,565.996 | 641.499 | 31.226 | 2.9170e-25 | TRUE |
| age\_group | 2 | 126.529 | 63.264 | 3.079 | 4.6201e-02 | TRUE |
| Residuals | 2,007 | 41,231.827 | 20.544 |  | NA |  |

NRB\_Lg\_em <- emmeans(NRB\_Lout, ~ gender)  
NRB\_Lg\_em1 <- as.data.frame(NRB\_Lg\_em)  
  
NRB\_Lg\_em

## gender emmean SE df lower.CL upper.CL  
## Female/Other 18.1 0.269 2007 17.6 18.7  
## Male 17.6 0.266 2007 17.1 18.2  
##   
## Results are averaged over the levels of: race\_eth, age\_group   
## Confidence level used: 0.95

NRB\_Lg\_em1 <- NRB\_Lg\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(NRB\_Lg\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: NRB\_L and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: NRB\_L and Gender (Imputed Data)

| **gender** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Female/Other | 18.134 | 0.269 | 2,007 | 17.605 | 18.662 |
| Male | 17.635 | 0.266 | 2,007 | 17.112 | 18.157 |

NRB\_Lg\_em2 <- pairs(NRB\_Lg\_em, adjust="Tukey")  
NRB\_Lg\_em3 <- as.data.frame(NRB\_Lg\_em2)  
  
NRB\_Lg\_em3$signif <- with(NRB\_Lg\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
NRB\_Lg\_em3$p.value <- formatC(NRB\_Lg\_em3$p.value, format = "e")  
  
NRB\_Lg\_em2

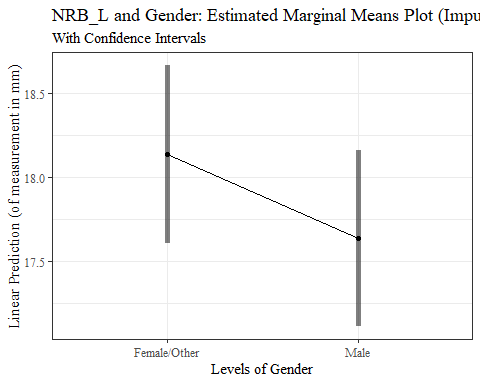
## contrast estimate SE df t.ratio p.value  
## (Female/Other) - Male 0.499 0.203 2007 2.455 0.0142  
##   
## Results are averaged over the levels of: race\_eth, age\_group

NRB\_Lg\_em3 <- NRB\_Lg\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(NRB\_Lg\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: NRB\_L and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: NRB\_L and Gender (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (Female/Other) - Male | 0.499 | 0.203 | 2,007 | 2.455 | 1.4186e-02 | TRUE |

emmip\_NRB\_Lg <- emmip(NRB\_Lout, ~ gender, CIs = TRUE)  
  
emmip\_NRB\_Lg +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="NRB\_L and Gender: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Gender")



NRB\_Lr\_em <- emmeans(NRB\_Lout, ~ race\_eth)  
NRB\_Lr\_em1 <- as.data.frame(NRB\_Lr\_em)  
  
NRB\_Lr\_em

## race\_eth emmean SE df lower.CL upper.CL  
## Asian 16.4 0.499 2007 15.5 17.4  
## Black 19.6 0.243 2007 19.1 20.0  
## LatinX 17.4 0.479 2007 16.5 18.3  
## Other 19.0 0.744 2007 17.5 20.4  
## white 17.0 0.196 2007 16.7 17.4  
##   
## Results are averaged over the levels of: gender, age\_group   
## Confidence level used: 0.95

NRB\_Lr\_em1 <- NRB\_Lr\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(NRB\_Lr\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: NRB\_L and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: NRB\_L and Race/Ethnicity (Imputed Data)

| **race\_eth** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Asian | 16.446 | 0.499 | 2,007 | 15.467 | 17.426 |
| Black | 19.551 | 0.243 | 2,007 | 19.073 | 20.028 |
| LatinX | 17.401 | 0.479 | 2,007 | 16.461 | 18.341 |
| Other | 18.984 | 0.744 | 2,007 | 17.524 | 20.444 |
| white | 17.039 | 0.196 | 2,007 | 16.654 | 17.424 |

NRB\_Lr\_em2 <- pairs(NRB\_Lr\_em, adjust="Tukey")  
NRB\_Lr\_em3 <- as.data.frame(NRB\_Lr\_em2)  
  
NRB\_Lr\_em3$signif <- with(NRB\_Lr\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
NRB\_Lr\_em3$p.value <- formatC(NRB\_Lr\_em3$p.value, format = "e")  
  
NRB\_Lr\_em2

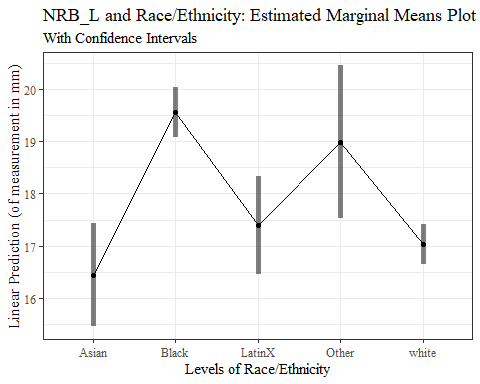
## contrast estimate SE df t.ratio p.value  
## Asian - Black -3.105 0.514 2007 -6.040 <.0001  
## Asian - LatinX -0.955 0.658 2007 -1.451 0.5949  
## Asian - Other -2.538 0.876 2007 -2.896 0.0313  
## Asian - white -0.592 0.493 2007 -1.202 0.7504  
## Black - LatinX 2.150 0.495 2007 4.339 0.0001  
## Black - Other 0.567 0.761 2007 0.745 0.9459  
## Black - white 2.512 0.233 2007 10.787 <.0001  
## LatinX - Other -1.583 0.866 2007 -1.828 0.3573  
## LatinX - white 0.363 0.474 2007 0.766 0.9404  
## Other - white 1.945 0.747 2007 2.603 0.0702  
##   
## Results are averaged over the levels of: gender, age\_group   
## P value adjustment: tukey method for comparing a family of 5 estimates

NRB\_Lr\_em3 <- NRB\_Lr\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(NRB\_Lr\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: NRB\_L and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: NRB\_L and Race/Ethnicity (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| Asian - Black | -3.105 | 0.514 | 2,007 | -6.040 | 1.8333e-08 | TRUE |
| Asian - LatinX | -0.955 | 0.658 | 2,007 | -1.451 | 5.9487e-01 | FALSE |
| Asian - Other | -2.538 | 0.876 | 2,007 | -2.896 | 3.1254e-02 | TRUE |
| Asian - white | -0.592 | 0.493 | 2,007 | -1.202 | 7.5037e-01 | FALSE |
| Black - LatinX | 2.150 | 0.495 | 2,007 | 4.339 | 1.4629e-04 | TRUE |
| Black - Other | 0.567 | 0.761 | 2,007 | 0.745 | 9.4594e-01 | FALSE |
| Black - white | 2.512 | 0.233 | 2,007 | 10.787 | 4.6529e-11 | TRUE |
| LatinX - Other | -1.583 | 0.866 | 2,007 | -1.828 | 3.5730e-01 | FALSE |
| LatinX - white | 0.363 | 0.474 | 2,007 | 0.766 | 9.4042e-01 | FALSE |
| Other - white | 1.945 | 0.747 | 2,007 | 2.603 | 7.0165e-02 | FALSE |

emmip\_NRB\_Lr <- emmip(NRB\_Lout, ~ race\_eth, CIs = TRUE)  
  
emmip\_NRB\_Lr +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="NRB\_L and Race/Ethnicity: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Race/Ethnicity")



ProS\_Lout <- aov(ProS\_L ~ gender+race\_eth+age\_group, data=chosen\_imputed1)  
summary(ProS\_Lout)

## Df Sum Sq Mean Sq F value Pr(>F)   
## gender 1 449 449.1 82.00 < 2e-16 \*\*\*  
## race\_eth 4 1139 284.8 52.00 < 2e-16 \*\*\*  
## age\_group 2 383 191.7 34.99 1.15e-15 \*\*\*  
## Residuals 2007 10993 5.5   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 1 observation deleted due to missingness

ProS\_Lout\_data <- as.data.frame(tidy(ProS\_Lout))

ProS\_Lout\_data <- rename(ProS\_Lout\_data, f.statistic = statistic)  
ProS\_Lout\_data$signif <- with(ProS\_Lout\_data, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
ProS\_Lout\_data$p.value <- formatC(ProS\_Lout\_data$p.value, format = "e")  
  
  
ProS\_Lout\_data <- ProS\_Lout\_data %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
#Autofit Width Table TNR  
flextable(ProS\_Lout\_data) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("ProS\_L Additive Anova Model Findings (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : ProS\_L Additive Anova Model Findings (Imputed Data)

| **term** | **df** | **sumsq** | **meansq** | **f.statistic** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| gender | 1 | 449.132 | 449.132 | 81.996 | 3.1441e-19 | TRUE |
| race\_eth | 4 | 1,139.310 | 284.827 | 52.000 | 1.0067e-41 | TRUE |
| age\_group | 2 | 383.345 | 191.673 | 34.993 | 1.1529e-15 | TRUE |
| Residuals | 2,007 | 10,993.338 | 5.477 |  | NA |  |

ProS\_Lg\_em <- emmeans(ProS\_Lout, ~ gender)  
ProS\_Lg\_em1 <- as.data.frame(ProS\_Lg\_em)  
  
ProS\_Lg\_em

## gender emmean SE df lower.CL upper.CL  
## Female/Other 18.2 0.139 2007 18 18.5  
## Male 19.3 0.138 2007 19 19.6  
##   
## Results are averaged over the levels of: race\_eth, age\_group   
## Confidence level used: 0.95

ProS\_Lg\_em1 <- ProS\_Lg\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(ProS\_Lg\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: ProS\_L and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: ProS\_L and Gender (Imputed Data)

| **gender** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Female/Other | 18.228 | 0.139 | 2,007 | 17.955 | 18.501 |
| Male | 19.285 | 0.138 | 2,007 | 19.015 | 19.554 |

ProS\_Lg\_em2 <- pairs(ProS\_Lg\_em, adjust="Tukey")  
ProS\_Lg\_em3 <- as.data.frame(ProS\_Lg\_em2)  
  
ProS\_Lg\_em3$signif <- with(ProS\_Lg\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
ProS\_Lg\_em3$p.value <- formatC(ProS\_Lg\_em3$p.value, format = "e")  
  
ProS\_Lg\_em2

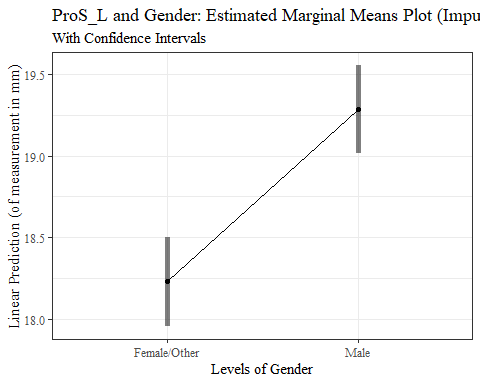
## contrast estimate SE df t.ratio p.value  
## (Female/Other) - Male -1.06 0.105 2007 -10.060 <.0001  
##   
## Results are averaged over the levels of: race\_eth, age\_group

ProS\_Lg\_em3 <- ProS\_Lg\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(ProS\_Lg\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: ProS\_L and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: ProS\_L and Gender (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (Female/Other) - Male | -1.057 | 0.105 | 2,007 | -10.06 | 2.9099e-23 | TRUE |

emmip\_ProS\_Lg <- emmip(ProS\_Lout, ~ gender, CIs = TRUE)  
  
emmip\_ProS\_Lg +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="ProS\_L and Gender: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Gender")



ProS\_Lr\_em <- emmeans(ProS\_Lout, ~ race\_eth)  
ProS\_Lr\_em1 <- as.data.frame(ProS\_Lr\_em)  
  
ProS\_Lr\_em

## race\_eth emmean SE df lower.CL upper.CL  
## Asian 18.4 0.258 2007 17.9 18.9  
## Black 18.3 0.126 2007 18.0 18.5  
## LatinX 19.0 0.247 2007 18.5 19.4  
## Other 18.2 0.384 2007 17.5 19.0  
## white 19.9 0.101 2007 19.7 20.1  
##   
## Results are averaged over the levels of: gender, age\_group   
## Confidence level used: 0.95

ProS\_Lr\_em1 <- ProS\_Lr\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(ProS\_Lr\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: ProS\_L and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: ProS\_L and Race/Ethnicity (Imputed Data)

| **race\_eth** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Asian | 18.373 | 0.258 | 2,007 | 17.867 | 18.879 |
| Black | 18.292 | 0.126 | 2,007 | 18.045 | 18.538 |
| LatinX | 18.959 | 0.247 | 2,007 | 18.474 | 19.445 |
| Other | 18.227 | 0.384 | 2,007 | 17.473 | 18.981 |
| white | 19.930 | 0.101 | 2,007 | 19.731 | 20.129 |

ProS\_Lr\_em2 <- pairs(ProS\_Lr\_em, adjust="Tukey")  
ProS\_Lr\_em3 <- as.data.frame(ProS\_Lr\_em2)  
  
ProS\_Lr\_em3$signif <- with(ProS\_Lr\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
ProS\_Lr\_em3$p.value <- formatC(ProS\_Lr\_em3$p.value, format = "e")  
  
ProS\_Lr\_em2

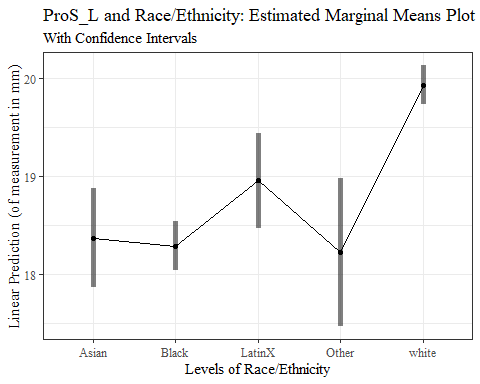
## contrast estimate SE df t.ratio p.value  
## Asian - Black 0.0812 0.265 2007 0.306 0.9981  
## Asian - LatinX -0.5865 0.340 2007 -1.725 0.4186  
## Asian - Other 0.1456 0.452 2007 0.322 0.9977  
## Asian - white -1.5573 0.255 2007 -6.118 <.0001  
## Black - LatinX -0.6676 0.256 2007 -2.610 0.0689  
## Black - Other 0.0644 0.393 2007 0.164 0.9998  
## Black - white -1.6385 0.120 2007 -13.626 <.0001  
## LatinX - Other 0.7321 0.447 2007 1.638 0.4732  
## LatinX - white -0.9708 0.245 2007 -3.970 0.0007  
## Other - white -1.7029 0.386 2007 -4.413 0.0001  
##   
## Results are averaged over the levels of: gender, age\_group   
## P value adjustment: tukey method for comparing a family of 5 estimates

ProS\_Lr\_em3 <- ProS\_Lr\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(ProS\_Lr\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: ProS\_L and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: ProS\_L and Race/Ethnicity (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| Asian - Black | 0.081 | 0.265 | 2,007 | 0.306 | 9.9810e-01 | FALSE |
| Asian - LatinX | -0.586 | 0.340 | 2,007 | -1.725 | 4.1855e-01 | FALSE |
| Asian - Other | 0.146 | 0.452 | 2,007 | 0.322 | 9.9768e-01 | FALSE |
| Asian - white | -1.557 | 0.255 | 2,007 | -6.118 | 1.1364e-08 | TRUE |
| Black - LatinX | -0.668 | 0.256 | 2,007 | -2.610 | 6.8928e-02 | FALSE |
| Black - Other | 0.064 | 0.393 | 2,007 | 0.164 | 9.9984e-01 | FALSE |
| Black - white | -1.638 | 0.120 | 2,007 | -13.626 | 4.6484e-11 | TRUE |
| LatinX - Other | 0.732 | 0.447 | 2,007 | 1.638 | 4.7319e-01 | FALSE |
| LatinX - white | -0.971 | 0.245 | 2,007 | -3.970 | 7.0932e-04 | TRUE |
| Other - white | -1.703 | 0.386 | 2,007 | -4.413 | 1.0482e-04 | TRUE |

emmip\_ProS\_Lr <- emmip(ProS\_Lout, ~ race\_eth, CIs = TRUE)  
  
emmip\_ProS\_Lr +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="ProS\_L and Race/Ethnicity: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Race/Ethnicity")



ProS\_La\_em <- emmeans(ProS\_Lout, ~ age\_group)  
ProS\_La\_em1 <- as.data.frame(ProS\_La\_em)  
  
ProS\_La\_em

## age\_group emmean SE df lower.CL upper.CL  
## 18-36 18.1 0.116 2007 17.9 18.4  
## 37-54 19.0 0.121 2007 18.8 19.2  
## 55-72 19.1 0.269 2007 18.6 19.7  
##   
## Results are averaged over the levels of: gender, race\_eth   
## Confidence level used: 0.95

ProS\_La\_em1 <- ProS\_La\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(ProS\_La\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: ProS\_L and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: ProS\_L and Age Group (Imputed Data)

| **age\_group** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| 18-36 | 18.131 | 0.116 | 2,007 | 17.903 | 18.359 |
| 37-54 | 18.993 | 0.121 | 2,007 | 18.756 | 19.230 |
| 55-72 | 19.145 | 0.269 | 2,007 | 18.617 | 19.672 |

ProS\_La\_em2 <- pairs(ProS\_La\_em, adjust="Tukey")  
ProS\_La\_em3 <- as.data.frame(ProS\_La\_em2)  
  
ProS\_La\_em3$signif <- with(ProS\_La\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
ProS\_La\_em3$p.value <- formatC(ProS\_La\_em3$p.value, format = "e")  
  
ProS\_La\_em2

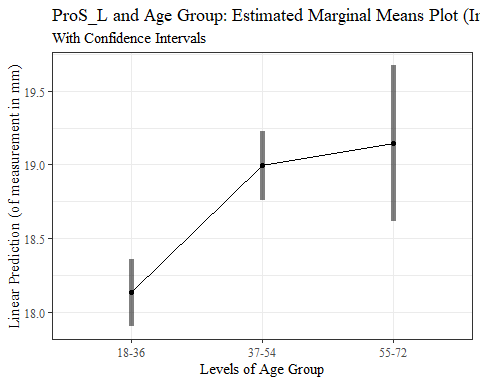
## contrast estimate SE df t.ratio p.value  
## (18-36) - (37-54) -0.862 0.107 2007 -8.043 <.0001  
## (18-36) - (55-72) -1.014 0.266 2007 -3.806 0.0004  
## (37-54) - (55-72) -0.152 0.267 2007 -0.568 0.8369  
##   
## Results are averaged over the levels of: gender, race\_eth   
## P value adjustment: tukey method for comparing a family of 3 estimates

ProS\_La\_em3 <- ProS\_La\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(ProS\_La\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: ProS\_L and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: ProS\_L and Age Group (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (18-36) - (37-54) | -0.862 | 0.107 | 2,007 | -8.043 | 4.6526e-11 | TRUE |
| (18-36) - (55-72) | -1.014 | 0.266 | 2,007 | -3.806 | 4.2653e-04 | TRUE |
| (37-54) - (55-72) | -0.152 | 0.267 | 2,007 | -0.568 | 8.3691e-01 | FALSE |

emmip\_ProS\_La <- emmip(ProS\_Lout, ~ age\_group, CIs = TRUE)  
  
emmip\_ProS\_La +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="ProS\_L and Age Group: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Age Group")



SelP\_Lout <- aov(SelP\_L ~ gender+race\_eth+age\_group, data=chosen\_imputed1)  
summary(SelP\_Lout)

## Df Sum Sq Mean Sq F value Pr(>F)   
## gender 1 6405 6405 440.107 < 2e-16 \*\*\*  
## race\_eth 4 1472 368 25.279 < 2e-16 \*\*\*  
## age\_group 2 244 122 8.368 0.00024 \*\*\*  
## Residuals 2007 29209 15   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 1 observation deleted due to missingness

SelP\_Lout\_data <- as.data.frame(tidy(SelP\_Lout))

SelP\_Lout\_data <- rename(SelP\_Lout\_data, f.statistic = statistic)  
SelP\_Lout\_data$signif <- with(SelP\_Lout\_data, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
SelP\_Lout\_data$p.value <- formatC(SelP\_Lout\_data$p.value, format = "e")  
  
  
SelP\_Lout\_data <- SelP\_Lout\_data %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
#Autofit Width Table TNR  
flextable(SelP\_Lout\_data) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("SelP\_L Additive Anova Model Findings (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : SelP\_L Additive Anova Model Findings (Imputed Data)

| **term** | **df** | **sumsq** | **meansq** | **f.statistic** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| gender | 1 | 6,405.128 | 6,405.128 | 440.107 | 1.6416e-88 | TRUE |
| race\_eth | 4 | 1,471.619 | 367.905 | 25.279 | 1.8589e-20 | TRUE |
| age\_group | 2 | 243.573 | 121.787 | 8.368 | 2.4034e-04 | TRUE |
| Residuals | 2,007 | 29,209.032 | 14.554 |  | NA |  |

SelP\_Lg\_em <- emmeans(SelP\_Lout, ~ gender)  
SelP\_Lg\_em1 <- as.data.frame(SelP\_Lg\_em)  
  
SelP\_Lg\_em

## gender emmean SE df lower.CL upper.CL  
## Female/Other 42.8 0.227 2007 42.4 43.3  
## Male 46.5 0.224 2007 46.1 46.9  
##   
## Results are averaged over the levels of: race\_eth, age\_group   
## Confidence level used: 0.95

SelP\_Lg\_em1 <- SelP\_Lg\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SelP\_Lg\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: SelP\_L and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: SelP\_L and Gender (Imputed Data)

| **gender** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Female/Other | 42.833 | 0.227 | 2,007 | 42.388 | 43.278 |
| Male | 46.497 | 0.224 | 2,007 | 46.058 | 46.937 |

SelP\_Lg\_em2 <- pairs(SelP\_Lg\_em, adjust="Tukey")  
SelP\_Lg\_em3 <- as.data.frame(SelP\_Lg\_em2)  
  
SelP\_Lg\_em3$signif <- with(SelP\_Lg\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
SelP\_Lg\_em3$p.value <- formatC(SelP\_Lg\_em3$p.value, format = "e")  
  
SelP\_Lg\_em2

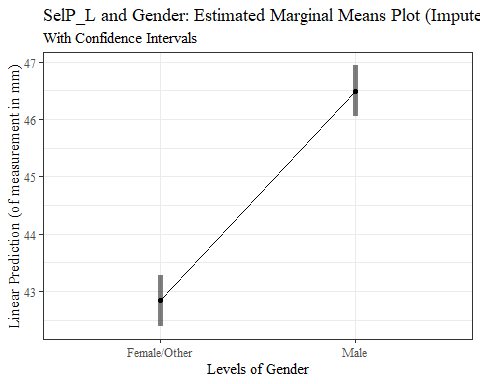
## contrast estimate SE df t.ratio p.value  
## (Female/Other) - Male -3.66 0.171 2007 -21.401 <.0001  
##   
## Results are averaged over the levels of: race\_eth, age\_group

SelP\_Lg\_em3 <- SelP\_Lg\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SelP\_Lg\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: SelP\_L and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: SelP\_L and Gender (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (Female/Other) - Male | -3.664 | 0.171 | 2,007 | -21.401 | 1.0765e-91 | TRUE |

emmip\_SelP\_Lg <- emmip(SelP\_Lout, ~ gender, CIs = TRUE)  
  
emmip\_SelP\_Lg +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="SelP\_L and Gender: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Gender")



SelP\_Lr\_em <- emmeans(SelP\_Lout, ~ race\_eth)  
SelP\_Lr\_em1 <- as.data.frame(SelP\_Lr\_em)  
  
SelP\_Lr\_em

## race\_eth emmean SE df lower.CL upper.CL  
## Asian 43.8 0.420 2007 43.0 44.6  
## Black 43.5 0.205 2007 43.1 43.9  
## LatinX 45.5 0.403 2007 44.7 46.3  
## Other 45.1 0.627 2007 43.9 46.3  
## white 45.4 0.165 2007 45.1 45.7  
##   
## Results are averaged over the levels of: gender, age\_group   
## Confidence level used: 0.95

SelP\_Lr\_em1 <- SelP\_Lr\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
  
flextable(SelP\_Lr\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: SelP\_L and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: SelP\_L and Race/Ethnicity (Imputed Data)

| **race\_eth** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Asian | 43.810 | 0.420 | 2,007 | 42.986 | 44.634 |
| Black | 43.491 | 0.205 | 2,007 | 43.089 | 43.893 |
| LatinX | 45.520 | 0.403 | 2,007 | 44.729 | 46.311 |
| Other | 45.110 | 0.627 | 2,007 | 43.881 | 46.339 |
| white | 45.395 | 0.165 | 2,007 | 45.071 | 45.720 |

SelP\_Lr\_em2 <- pairs(SelP\_Lr\_em, adjust="Tukey")  
SelP\_Lr\_em3 <- as.data.frame(SelP\_Lr\_em2)  
  
SelP\_Lr\_em3$signif <- with(SelP\_Lr\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
SelP\_Lr\_em3$p.value <- formatC(SelP\_Lr\_em3$p.value, format = "e")  
  
SelP\_Lr\_em2

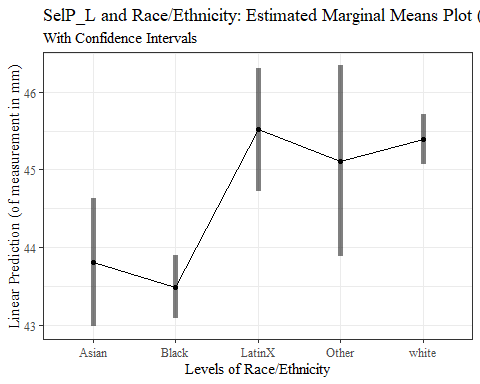
## contrast estimate SE df t.ratio p.value  
## Asian - Black 0.319 0.433 2007 0.737 0.9477  
## Asian - LatinX -1.710 0.554 2007 -3.085 0.0176  
## Asian - Other -1.300 0.738 2007 -1.763 0.3957  
## Asian - white -1.586 0.415 2007 -3.822 0.0013  
## Black - LatinX -2.029 0.417 2007 -4.865 <.0001  
## Black - Other -1.619 0.641 2007 -2.527 0.0851  
## Black - white -1.905 0.196 2007 -9.717 <.0001  
## LatinX - Other 0.409 0.729 2007 0.562 0.9804  
## LatinX - white 0.124 0.399 2007 0.311 0.9980  
## Other - white -0.285 0.629 2007 -0.454 0.9913  
##   
## Results are averaged over the levels of: gender, age\_group   
## P value adjustment: tukey method for comparing a family of 5 estimates

SelP\_Lr\_em3 <- SelP\_Lr\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
  
flextable(SelP\_Lr\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: SelP\_L and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: SelP\_L and Race/Ethnicity (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| Asian - Black | 0.319 | 0.433 | 2,007 | 0.737 | 9.4772e-01 | FALSE |
| Asian - LatinX | -1.710 | 0.554 | 2,007 | -3.085 | 1.7568e-02 | TRUE |
| Asian - Other | -1.300 | 0.738 | 2,007 | -1.763 | 3.9572e-01 | FALSE |
| Asian - white | -1.586 | 0.415 | 2,007 | -3.822 | 1.2859e-03 | TRUE |
| Black - LatinX | -2.029 | 0.417 | 2,007 | -4.865 | 1.2188e-05 | TRUE |
| Black - Other | -1.619 | 0.641 | 2,007 | -2.527 | 8.5147e-02 | FALSE |
| Black - white | -1.905 | 0.196 | 2,007 | -9.717 | 4.6532e-11 | TRUE |
| LatinX - Other | 0.409 | 0.729 | 2,007 | 0.562 | 9.8045e-01 | FALSE |
| LatinX - white | 0.124 | 0.399 | 2,007 | 0.311 | 9.9797e-01 | FALSE |
| Other - white | -0.285 | 0.629 | 2,007 | -0.454 | 9.9126e-01 | FALSE |

emmip\_SelP\_Lr <- emmip(SelP\_Lout, ~ race\_eth, CIs = TRUE)  
  
emmip\_SelP\_Lr +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="SelP\_L and Race/Ethnicity: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Race/Ethnicity")



SelP\_La\_em <- emmeans(SelP\_Lout, ~ age\_group)  
SelP\_La\_em1 <- as.data.frame(SelP\_La\_em)  
  
SelP\_La\_em

## age\_group emmean SE df lower.CL upper.CL  
## 18-36 44.2 0.189 2007 43.8 44.5  
## 37-54 44.8 0.197 2007 44.5 45.2  
## 55-72 45.0 0.438 2007 44.1 45.8  
##   
## Results are averaged over the levels of: gender, race\_eth   
## Confidence level used: 0.95

SelP\_La\_em1 <- SelP\_La\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SelP\_La\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: SelP\_L and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: SelP\_L and Age Group (Imputed Data)

| **age\_group** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| 18-36 | 44.164 | 0.189 | 2,007 | 43.792 | 44.535 |
| 37-54 | 44.849 | 0.197 | 2,007 | 44.463 | 45.235 |
| 55-72 | 44.983 | 0.438 | 2,007 | 44.123 | 45.842 |

SelP\_La\_em2 <- pairs(SelP\_La\_em, adjust="Tukey")  
SelP\_La\_em3 <- as.data.frame(SelP\_La\_em2)  
  
SelP\_La\_em3$signif <- with(SelP\_La\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
SelP\_La\_em3$p.value <- formatC(SelP\_La\_em3$p.value, format = "e")  
  
SelP\_La\_em2

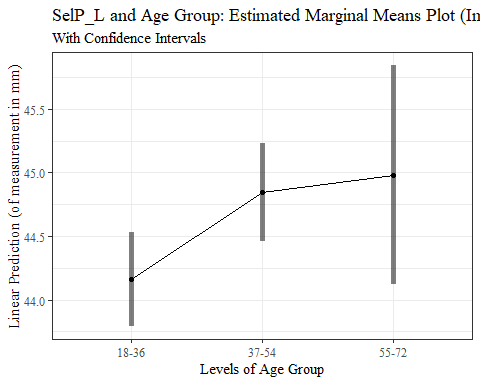
## contrast estimate SE df t.ratio p.value  
## (18-36) - (37-54) -0.686 0.175 2007 -3.925 0.0003  
## (18-36) - (55-72) -0.819 0.434 2007 -1.887 0.1428  
## (37-54) - (55-72) -0.133 0.436 2007 -0.306 0.9496  
##   
## Results are averaged over the levels of: gender, race\_eth   
## P value adjustment: tukey method for comparing a family of 3 estimates

SelP\_La\_em3 <- SelP\_La\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SelP\_La\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: SelP\_L and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: SelP\_L and Age Group (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (18-36) - (37-54) | -0.686 | 0.175 | 2,007 | -3.925 | 2.6383e-04 | TRUE |
| (18-36) - (55-72) | -0.819 | 0.434 | 2,007 | -1.887 | 1.4276e-01 | FALSE |
| (37-54) - (55-72) | -0.133 | 0.436 | 2,007 | -0.306 | 9.4957e-01 | FALSE |

emmip\_SelP\_La <- emmip(SelP\_Lout, ~ age\_group, CIs = TRUE)  
  
emmip\_SelP\_La +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="SelP\_L and Age Group: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Age Group")



SelM\_Lout <- aov(SelM\_L ~ gender+race\_eth+age\_group, data=chosen\_imputed1)  
summary(SelM\_Lout)

## Df Sum Sq Mean Sq F value Pr(>F)   
## gender 1 30773 30773 474.675 < 2e-16 \*\*\*  
## race\_eth 4 5092 1273 19.637 7.2e-16 \*\*\*  
## age\_group 2 1047 524 8.078 0.00032 \*\*\*  
## Residuals 2007 130114 65   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 1 observation deleted due to missingness

SelM\_Lout\_data <- as.data.frame(tidy(SelM\_Lout))

SelM\_Lout\_data <- rename(SelM\_Lout\_data, f.statistic = statistic)  
SelM\_Lout\_data$signif <- with(SelM\_Lout\_data, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
SelM\_Lout\_data$p.value <- formatC(SelM\_Lout\_data$p.value, format = "e")  
  
SelM\_Lout\_data <- SelM\_Lout\_data %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
#Autofit Width Table TNR  
flextable(SelM\_Lout\_data) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("SelM\_L Additive Anova Model Findings (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : SelM\_L Additive Anova Model Findings (Imputed Data)

| **term** | **df** | **sumsq** | **meansq** | **f.statistic** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| gender | 1 | 30,773.159 | 30,773.159 | 474.675 | 1.2263e-94 | TRUE |
| race\_eth | 4 | 5,092.277 | 1,273.069 | 19.637 | 7.2036e-16 | TRUE |
| age\_group | 2 | 1,047.443 | 523.722 | 8.078 | 3.2036e-04 | TRUE |
| Residuals | 2,007 | 130,113.619 | 64.830 |  | NA |  |

SelM\_Lg\_em <- emmeans(SelM\_Lout, ~ gender)  
SelM\_Lg\_em1 <- as.data.frame(SelM\_Lg\_em)  
  
SelM\_Lg\_em

## gender emmean SE df lower.CL upper.CL  
## Female/Other 112 0.479 2007 111 113  
## Male 120 0.473 2007 119 121  
##   
## Results are averaged over the levels of: race\_eth, age\_group   
## Confidence level used: 0.95

SelM\_Lg\_em1 <- SelM\_Lg\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SelM\_Lg\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: SelM\_L and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: SelM\_L and Gender (Imputed Data)

| **gender** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Female/Other | 111.820 | 0.479 | 2,007 | 110.882 | 112.759 |
| Male | 119.824 | 0.473 | 2,007 | 118.896 | 120.752 |

SelM\_Lg\_em2 <- pairs(SelM\_Lg\_em, adjust="Tukey")  
SelM\_Lg\_em3 <- as.data.frame(SelM\_Lg\_em2)  
  
SelM\_Lg\_em3$signif <- with(SelM\_Lg\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
SelM\_Lg\_em3$p.value <- formatC(SelM\_Lg\_em3$p.value, format = "e")  
  
SelM\_Lg\_em2

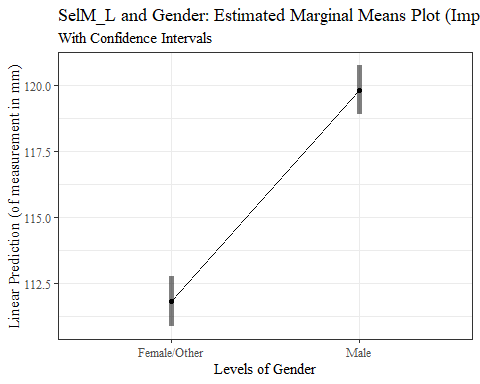
## contrast estimate SE df t.ratio p.value  
## (Female/Other) - Male -8 0.361 2007 -22.149 <.0001  
##   
## Results are averaged over the levels of: race\_eth, age\_group

SelM\_Lg\_em3 <- SelM\_Lg\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SelM\_Lg\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: SelM\_L and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: SelM\_L and Gender (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (Female/Other) - Male | -8.003 | 0.361 | 2,007 | -22.149 | 1.9838e-97 | TRUE |

emmip\_SelM\_Lg <- emmip(SelM\_Lout, ~ gender, CIs = TRUE)  
  
emmip\_SelM\_Lg +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="SelM\_L and Gender: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Gender")



SelM\_Lr\_em <- emmeans(SelM\_Lout, ~ race\_eth)  
SelM\_Lr\_em1 <- as.data.frame(SelM\_Lr\_em)  
  
SelM\_Lr\_em

## race\_eth emmean SE df lower.CL upper.CL  
## Asian 112 0.887 2007 110 114  
## Black 119 0.432 2007 118 120  
## LatinX 116 0.851 2007 115 118  
## Other 116 1.322 2007 113 118  
## white 116 0.349 2007 116 117  
##   
## Results are averaged over the levels of: gender, age\_group   
## Confidence level used: 0.95

SelM\_Lr\_em1 <- SelM\_Lr\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SelM\_Lr\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: SelM\_L and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: SelM\_L and Race/Ethnicity (Imputed Data)

| **race\_eth** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Asian | 111.833 | 0.887 | 2,007 | 110.093 | 113.573 |
| Black | 118.845 | 0.432 | 2,007 | 117.997 | 119.693 |
| LatinX | 116.333 | 0.851 | 2,007 | 114.664 | 118.003 |
| Other | 115.726 | 1.322 | 2,007 | 113.132 | 118.319 |
| white | 116.373 | 0.349 | 2,007 | 115.689 | 117.058 |

SelM\_Lr\_em2 <- pairs(SelM\_Lr\_em, adjust="Tukey")  
SelM\_Lr\_em3 <- as.data.frame(SelM\_Lr\_em2)  
  
SelM\_Lr\_em3$signif <- with(SelM\_Lr\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
SelM\_Lr\_em3$p.value <- formatC(SelM\_Lr\_em3$p.value, format = "e")  
  
SelM\_Lr\_em2

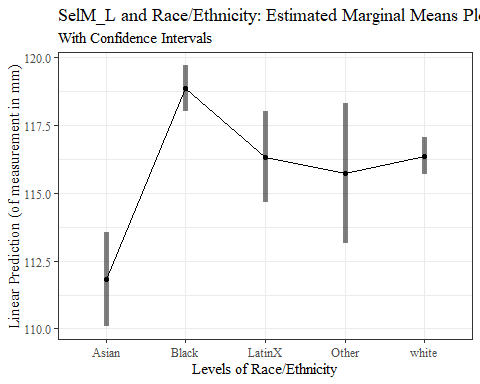
## contrast estimate SE df t.ratio p.value  
## Asian - Black -7.0126 0.913 2007 -7.680 <.0001  
## Asian - LatinX -4.5004 1.169 2007 -3.848 0.0012  
## Asian - Other -3.8929 1.557 2007 -2.501 0.0908  
## Asian - white -4.5407 0.876 2007 -5.186 <.0001  
## Black - LatinX 2.5122 0.880 2007 2.855 0.0353  
## Black - Other 3.1197 1.353 2007 2.307 0.1431  
## Black - white 2.4719 0.414 2007 5.975 <.0001  
## LatinX - Other 0.6075 1.538 2007 0.395 0.9949  
## LatinX - white -0.0403 0.841 2007 -0.048 1.0000  
## Other - white -0.6479 1.328 2007 -0.488 0.9885  
##   
## Results are averaged over the levels of: gender, age\_group   
## P value adjustment: tukey method for comparing a family of 5 estimates

SelM\_Lr\_em3 <- SelM\_Lr\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SelM\_Lr\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: SelM\_L and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: SelM\_L and Race/Ethnicity (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| Asian - Black | -7.013 | 0.913 | 2,007 | -7.680 | 4.6765e-11 | TRUE |
| Asian - LatinX | -4.500 | 1.169 | 2,007 | -3.848 | 1.1590e-03 | TRUE |
| Asian - Other | -3.893 | 1.557 | 2,007 | -2.501 | 9.0809e-02 | FALSE |
| Asian - white | -4.541 | 0.876 | 2,007 | -5.186 | 2.3542e-06 | TRUE |
| Black - LatinX | 2.512 | 0.880 | 2,007 | 2.855 | 3.5259e-02 | TRUE |
| Black - Other | 3.120 | 1.353 | 2,007 | 2.307 | 1.4312e-01 | FALSE |
| Black - white | 2.472 | 0.414 | 2,007 | 5.975 | 2.7139e-08 | TRUE |
| LatinX - Other | 0.608 | 1.538 | 2,007 | 0.395 | 9.9486e-01 | FALSE |
| LatinX - white | -0.040 | 0.841 | 2,007 | -0.048 | 1.0000e+00 | FALSE |
| Other - white | -0.648 | 1.328 | 2,007 | -0.488 | 9.8848e-01 | FALSE |

emmip\_SelM\_Lr <- emmip(SelM\_Lout, ~ race\_eth, CIs = TRUE)  
  
emmip\_SelM\_Lr +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="SelM\_L and Race/Ethnicity: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Race/Ethnicity")



SelM\_La\_em <- emmeans(SelM\_Lout, ~ age\_group)  
SelM\_La\_em1 <- as.data.frame(SelM\_La\_em)  
  
SelM\_La\_em

## age\_group emmean SE df lower.CL upper.CL  
## 18-36 116 0.400 2007 115 116  
## 37-54 117 0.416 2007 116 118  
## 55-72 115 0.925 2007 113 117  
##   
## Results are averaged over the levels of: gender, race\_eth   
## Confidence level used: 0.95

SelM\_La\_em1 <- SelM\_La\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SelM\_La\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: SelM\_L and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: SelM\_L and Age Group (Imputed Data)

| **age\_group** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| 18-36 | 115.622 | 0.400 | 2,007 | 114.838 | 116.406 |
| 37-54 | 116.985 | 0.416 | 2,007 | 116.170 | 117.800 |
| 55-72 | 114.859 | 0.925 | 2,007 | 113.045 | 116.674 |

SelM\_La\_em2 <- pairs(SelM\_La\_em, adjust="Tukey")  
SelM\_La\_em3 <- as.data.frame(SelM\_La\_em2)  
  
SelM\_La\_em3$signif <- with(SelM\_La\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
SelM\_La\_em3$p.value <- formatC(SelM\_La\_em3$p.value, format = "e")  
  
SelM\_La\_em2

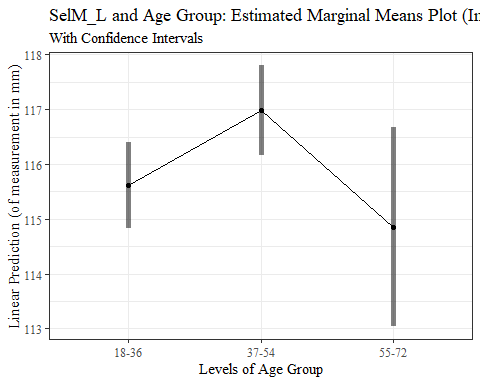
## contrast estimate SE df t.ratio p.value  
## (18-36) - (37-54) -1.363 0.369 2007 -3.699 0.0007  
## (18-36) - (55-72) 0.762 0.916 2007 0.832 0.6830  
## (37-54) - (55-72) 2.126 0.919 2007 2.312 0.0543  
##   
## Results are averaged over the levels of: gender, race\_eth   
## P value adjustment: tukey method for comparing a family of 3 estimates

SelM\_La\_em3 <- SelM\_La\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SelM\_La\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: SelM\_L and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: SelM\_L and Age Group (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (18-36) - (37-54) | -1.363 | 0.369 | 2,007 | -3.699 | 6.5142e-04 | TRUE |
| (18-36) - (55-72) | 0.762 | 0.916 | 2,007 | 0.832 | 6.8304e-01 | FALSE |
| (37-54) - (55-72) | 2.126 | 0.919 | 2,007 | 2.312 | 5.4340e-02 | FALSE |

emmip\_SelM\_La <- emmip(SelM\_Lout, ~ age\_group, CIs = TRUE)  
  
emmip\_SelM\_La +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="SelM\_L and Age Group: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Age Group")



SnasM\_Cout <- aov(SnasM\_C ~ gender+race\_eth+age\_group, data=chosen\_imputed1)  
summary(SnasM\_Cout)

## Df Sum Sq Mean Sq F value Pr(>F)   
## gender 1 15433 15433 181.679 <2e-16 \*\*\*  
## race\_eth 4 22468 5617 66.122 <2e-16 \*\*\*  
## age\_group 2 551 275 3.241 0.0393 \*   
## Residuals 2007 170490 85   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 1 observation deleted due to missingness

SnasM\_Cout\_data <- as.data.frame(tidy(SnasM\_Cout))

SnasM\_Cout\_data <- rename(SnasM\_Cout\_data, f.statistic = statistic)  
SnasM\_Cout\_data$signif <- with(SnasM\_Cout\_data, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
SnasM\_Cout\_data$p.value <- formatC(SnasM\_Cout\_data$p.value, format = "e")  
  
SnasM\_Cout\_data <- SnasM\_Cout\_data %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
#Autofit Width Table TNR  
flextable(SnasM\_Cout\_data) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("SnasM\_C Additive Anova Model Findings (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : SnasM\_C Additive Anova Model Findings (Imputed Data)

| **term** | **df** | **sumsq** | **meansq** | **f.statistic** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| gender | 1 | 15,433.216 | 15,433.216 | 181.679 | 1.0527e-39 | TRUE |
| race\_eth | 4 | 22,467.686 | 5,616.921 | 66.122 | 1.3184e-52 | TRUE |
| age\_group | 2 | 550.598 | 275.299 | 3.241 | 3.9337e-02 | TRUE |
| Residuals | 2,007 | 170,490.258 | 84.948 |  | NA |  |

SnasM\_Cg\_em <- emmeans(SnasM\_Cout, ~ gender)  
SnasM\_Cg\_em1 <- as.data.frame(SnasM\_Cg\_em)  
  
SnasM\_Cg\_em

## gender emmean SE df lower.CL upper.CL  
## Female/Other 71.7 0.548 2007 70.6 72.8  
## Male 77.2 0.542 2007 76.2 78.3  
##   
## Results are averaged over the levels of: race\_eth, age\_group   
## Confidence level used: 0.95

SnasM\_Cg\_em1 <- SnasM\_Cg\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SnasM\_Cg\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: SnasM\_C and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: SnasM\_C and Gender (Imputed Data)

| **gender** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Female/Other | 71.706 | 0.548 | 2,007 | 70.632 | 72.781 |
| Male | 77.246 | 0.542 | 2,007 | 76.184 | 78.308 |

SnasM\_Cg\_em2 <- pairs(SnasM\_Cg\_em, adjust="Tukey")  
SnasM\_Cg\_em3 <- as.data.frame(SnasM\_Cg\_em2)  
  
SnasM\_Cg\_em3$signif <- with(SnasM\_Cg\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
SnasM\_Cg\_em3$p.value <- formatC(SnasM\_Cg\_em3$p.value, format = "e")  
  
SnasM\_Cg\_em2

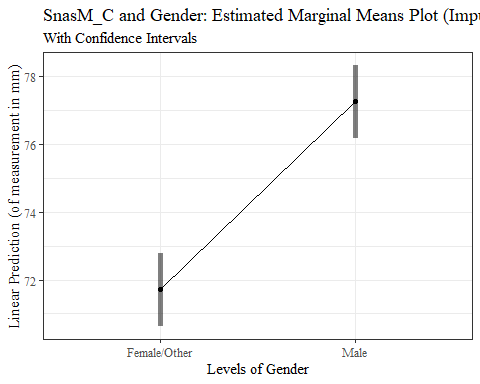
## contrast estimate SE df t.ratio p.value  
## (Female/Other) - Male -5.54 0.414 2007 -13.393 <.0001  
##   
## Results are averaged over the levels of: race\_eth, age\_group

SnasM\_Cg\_em3 <- SnasM\_Cg\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SnasM\_Cg\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: SnasM\_C and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: SnasM\_C and Gender (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (Female/Other) - Male | -5.54 | 0.414 | 2,007 | -13.393 | 3.0552e-39 | TRUE |

emmip\_SnasM\_Cg <- emmip(SnasM\_Cout, ~ gender, CIs = TRUE)  
  
emmip\_SnasM\_Cg +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="SnasM\_C and Gender: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Gender")



SnasM\_Cr\_em <- emmeans(SnasM\_Cout, ~ race\_eth)  
SnasM\_Cr\_em1 <- as.data.frame(SnasM\_Cr\_em)  
  
SnasM\_Cr\_em

## race\_eth emmean SE df lower.CL upper.CL  
## Asian 71.0 1.016 2007 69.0 73.0  
## Black 80.5 0.495 2007 79.5 81.4  
## LatinX 73.8 0.974 2007 71.9 75.7  
## Other 74.0 1.514 2007 71.0 77.0  
## white 73.1 0.399 2007 72.3 73.9  
##   
## Results are averaged over the levels of: gender, age\_group   
## Confidence level used: 0.95

SnasM\_Cr\_em1 <- SnasM\_Cr\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SnasM\_Cr\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: SnasM\_C and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: SnasM\_C and Race/Ethnicity (Imputed Data)

| **race\_eth** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Asian | 71.013 | 1.016 | 2,007 | 69.021 | 73.005 |
| Black | 80.451 | 0.495 | 2,007 | 79.480 | 81.422 |
| LatinX | 73.835 | 0.974 | 2,007 | 71.924 | 75.746 |
| Other | 73.996 | 1.514 | 2,007 | 71.027 | 76.965 |
| white | 73.086 | 0.399 | 2,007 | 72.302 | 73.869 |

SnasM\_Cr\_em2 <- pairs(SnasM\_Cr\_em, adjust="Tukey")  
SnasM\_Cr\_em3 <- as.data.frame(SnasM\_Cr\_em2)  
  
SnasM\_Cr\_em3$signif <- with(SnasM\_Cr\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
SnasM\_Cr\_em3$p.value <- formatC(SnasM\_Cr\_em3$p.value, format = "e")  
  
SnasM\_Cr\_em2

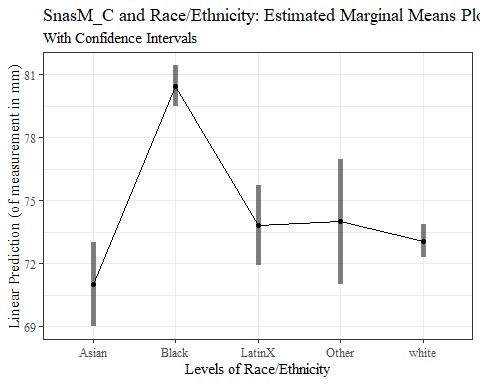
## contrast estimate SE df t.ratio p.value  
## Asian - Black -9.438 1.045 2007 -9.030 <.0001  
## Asian - LatinX -2.822 1.339 2007 -2.108 0.2169  
## Asian - Other -2.983 1.782 2007 -1.674 0.4502  
## Asian - white -2.073 1.002 2007 -2.068 0.2345  
## Black - LatinX 6.616 1.007 2007 6.567 <.0001  
## Black - Other 6.455 1.548 2007 4.169 0.0003  
## Black - white 7.365 0.474 2007 15.553 <.0001  
## LatinX - Other -0.161 1.760 2007 -0.092 1.0000  
## LatinX - white 0.749 0.963 2007 0.778 0.9370  
## Other - white 0.911 1.520 2007 0.599 0.9752  
##   
## Results are averaged over the levels of: gender, age\_group   
## P value adjustment: tukey method for comparing a family of 5 estimates

SnasM\_Cr\_em3 <- SnasM\_Cr\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(SnasM\_Cr\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: SnasM\_C and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: SnasM\_C and Race/Ethnicity (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| Asian - Black | -9.438 | 1.045 | 2,007 | -9.030 | 4.6530e-11 | TRUE |
| Asian - LatinX | -2.822 | 1.339 | 2,007 | -2.108 | 2.1692e-01 | FALSE |
| Asian - Other | -2.983 | 1.782 | 2,007 | -1.674 | 4.5018e-01 | FALSE |
| Asian - white | -2.073 | 1.002 | 2,007 | -2.068 | 2.3449e-01 | FALSE |
| Black - LatinX | 6.616 | 1.007 | 2,007 | 6.567 | 6.9726e-10 | TRUE |
| Black - Other | 6.455 | 1.548 | 2,007 | 4.169 | 3.0774e-04 | TRUE |
| Black - white | 7.365 | 0.474 | 2,007 | 15.553 | 4.6484e-11 | TRUE |
| LatinX - Other | -0.161 | 1.760 | 2,007 | -0.092 | 9.9998e-01 | FALSE |
| LatinX - white | 0.749 | 0.963 | 2,007 | 0.778 | 9.3699e-01 | FALSE |
| Other - white | 0.911 | 1.520 | 2,007 | 0.599 | 9.7523e-01 | FALSE |

emmip\_SnasM\_Cr <- emmip(SnasM\_Cout, ~ race\_eth, CIs = TRUE)  
  
emmip\_SnasM\_Cr +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="SnasM\_C and Race/Ethnicity: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Race/Ethnicity")



TrSman\_Cout <- aov(TrSman\_C ~ gender+race\_eth+age\_group, data=chosen\_imputed1)  
summary(TrSman\_Cout)

## Df Sum Sq Mean Sq F value Pr(>F)   
## gender 1 101923 101923 810.93 < 2e-16 \*\*\*  
## race\_eth 4 9802 2450 19.50 9.39e-16 \*\*\*  
## age\_group 2 19773 9886 78.66 < 2e-16 \*\*\*  
## Residuals 2007 252253 126   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 1 observation deleted due to missingness

TrSman\_Cout\_data <- as.data.frame(tidy(TrSman\_Cout))

TrSman\_Cout\_data <- rename(TrSman\_Cout\_data, f.statistic = statistic)  
TrSman\_Cout\_data$signif <- with(TrSman\_Cout\_data, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
TrSman\_Cout\_data$p.value <- formatC(TrSman\_Cout\_data$p.value, format = "e")  
  
TrSman\_Cout\_data <- TrSman\_Cout\_data %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
#Autofit Width Table TNR  
flextable(TrSman\_Cout\_data) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("TrSman\_C Additive Anova Model Findings (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : TrSman\_C Additive Anova Model Findings (Imputed Data)

| **term** | **df** | **sumsq** | **meansq** | **f.statistic** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| gender | 1 | 101,922.850 | 101,922.850 | 810.929 | 4.1881e-150 | TRUE |
| race\_eth | 4 | 9,801.583 | 2,450.396 | 19.496 | 9.3857e-16 | TRUE |
| age\_group | 2 | 19,772.677 | 9,886.339 | 78.659 | 1.2933e-33 | TRUE |
| Residuals | 2,007 | 252,252.827 | 125.687 |  | NA |  |

TrSman\_Cg\_em <- emmeans(TrSman\_Cout, ~ gender)  
TrSman\_Cg\_em1 <- as.data.frame(TrSman\_Cg\_em)  
  
TrSman\_Cg\_em

## gender emmean SE df lower.CL upper.CL  
## Female/Other 147 0.667 2007 146 148  
## Male 162 0.659 2007 161 163  
##   
## Results are averaged over the levels of: race\_eth, age\_group   
## Confidence level used: 0.95

TrSman\_Cg\_em1 <- TrSman\_Cg\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrSman\_Cg\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: TrSman\_C and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: TrSman\_C and Gender (Imputed Data)

| **gender** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Female/Other | 147.151 | 0.667 | 2,007 | 145.844 | 148.458 |
| Male | 161.819 | 0.659 | 2,007 | 160.527 | 163.111 |

TrSman\_Cg\_em2 <- pairs(TrSman\_Cg\_em, adjust="Tukey")  
TrSman\_Cg\_em3 <- as.data.frame(TrSman\_Cg\_em2)  
  
TrSman\_Cg\_em3$signif <- with(TrSman\_Cg\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
TrSman\_Cg\_em3$p.value <- formatC(TrSman\_Cg\_em3$p.value, format = "e")  
  
TrSman\_Cg\_em2

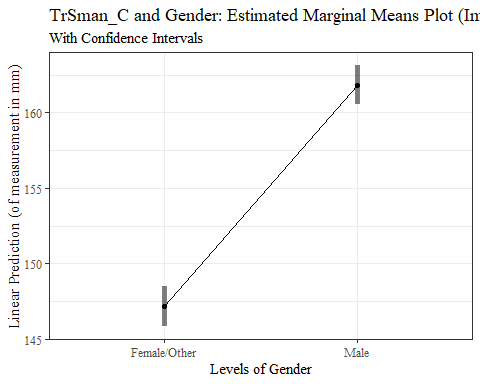
## contrast estimate SE df t.ratio p.value  
## (Female/Other) - Male -14.7 0.503 2007 -29.154 <.0001  
##   
## Results are averaged over the levels of: race\_eth, age\_group

TrSman\_Cg\_em3 <- TrSman\_Cg\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrSman\_Cg\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: TrSman\_C and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: TrSman\_C and Gender (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (Female/Other) - Male | -14.668 | 0.503 | 2,007 | -29.154 | 4.1901e-156 | TRUE |

emmip\_TrSman\_Cg <- emmip(TrSman\_Cout, ~ gender, CIs = TRUE)  
  
emmip\_TrSman\_Cg +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="TrSman\_C and Gender: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Gender")



TrSman\_Cr\_em <- emmeans(TrSman\_Cout, ~ race\_eth)  
TrSman\_Cr\_em1 <- as.data.frame(TrSman\_Cr\_em)  
  
TrSman\_Cr\_em

## race\_eth emmean SE df lower.CL upper.CL  
## Asian 152 1.235 2007 149 154  
## Black 159 0.602 2007 157 160  
## LatinX 154 1.185 2007 152 157  
## Other 153 1.841 2007 150 157  
## white 155 0.486 2007 154 155  
##   
## Results are averaged over the levels of: gender, age\_group   
## Confidence level used: 0.95

TrSman\_Cr\_em1 <- TrSman\_Cr\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrSman\_Cr\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: TrSman\_C and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: TrSman\_C and Race/Ethnicity (Imputed Data)

| **race\_eth** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Asian | 151.819 | 1.235 | 2,007 | 149.396 | 154.241 |
| Black | 158.626 | 0.602 | 2,007 | 157.445 | 159.807 |
| LatinX | 154.316 | 1.185 | 2,007 | 151.991 | 156.640 |
| Other | 153.133 | 1.841 | 2,007 | 149.522 | 156.744 |
| white | 154.532 | 0.486 | 2,007 | 153.579 | 155.484 |

TrSman\_Cr\_em2 <- pairs(TrSman\_Cr\_em, adjust="Tukey")  
TrSman\_Cr\_em3 <- as.data.frame(TrSman\_Cr\_em2)  
  
TrSman\_Cr\_em3$signif <- with(TrSman\_Cr\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
TrSman\_Cr\_em3$p.value <- formatC(TrSman\_Cr\_em3$p.value, format = "e")  
  
TrSman\_Cr\_em2

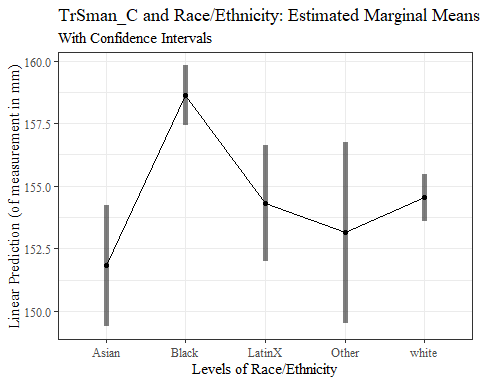
## contrast estimate SE df t.ratio p.value  
## Asian - Black -6.807 1.271 2007 -5.354 <.0001  
## Asian - LatinX -2.497 1.628 2007 -1.533 0.5407  
## Asian - Other -1.315 2.167 2007 -0.607 0.9741  
## Asian - white -2.713 1.219 2007 -2.225 0.1707  
## Black - LatinX 4.310 1.225 2007 3.517 0.0041  
## Black - Other 5.493 1.883 2007 2.917 0.0294  
## Black - white 4.094 0.576 2007 7.108 <.0001  
## LatinX - Other 1.182 2.141 2007 0.552 0.9817  
## LatinX - white -0.216 1.171 2007 -0.184 0.9997  
## Other - white -1.398 1.848 2007 -0.756 0.9428  
##   
## Results are averaged over the levels of: gender, age\_group   
## P value adjustment: tukey method for comparing a family of 5 estimates

TrSman\_Cr\_em3 <- TrSman\_Cr\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrSman\_Cr\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: TrSman\_C and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: TrSman\_C and Race/Ethnicity (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| Asian - Black | -6.807 | 1.271 | 2,007 | -5.354 | 9.5178e-07 | TRUE |
| Asian - LatinX | -2.497 | 1.628 | 2,007 | -1.533 | 5.4069e-01 | FALSE |
| Asian - Other | -1.315 | 2.167 | 2,007 | -0.607 | 9.7409e-01 | FALSE |
| Asian - white | -2.713 | 1.219 | 2,007 | -2.225 | 1.7071e-01 | FALSE |
| Black - LatinX | 4.310 | 1.225 | 2,007 | 3.517 | 4.0678e-03 | TRUE |
| Black - Other | 5.493 | 1.883 | 2,007 | 2.917 | 2.9417e-02 | TRUE |
| Black - white | 4.094 | 0.576 | 2,007 | 7.108 | 6.2836e-11 | TRUE |
| LatinX - Other | 1.182 | 2.141 | 2,007 | 0.552 | 9.8168e-01 | FALSE |
| LatinX - white | -0.216 | 1.171 | 2,007 | -0.184 | 9.9974e-01 | FALSE |
| Other - white | -1.398 | 1.848 | 2,007 | -0.756 | 9.4284e-01 | FALSE |

emmip\_TrSman\_Cr <- emmip(TrSman\_Cout, ~ race\_eth, CIs = TRUE)  
  
emmip\_TrSman\_Cr +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="TrSman\_C and Race/Ethnicity: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Race/Ethnicity")



TrSman\_Ca\_em <- emmeans(TrSman\_Cout, ~ age\_group)  
TrSman\_Ca\_em1 <- as.data.frame(TrSman\_Ca\_em)  
  
TrSman\_Ca\_em

## age\_group emmean SE df lower.CL upper.CL  
## 18-36 150 0.557 2007 149 151  
## 37-54 156 0.579 2007 155 157  
## 55-72 157 1.288 2007 155 160  
##   
## Results are averaged over the levels of: gender, race\_eth   
## Confidence level used: 0.95

TrSman\_Ca\_em1 <- TrSman\_Ca\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrSman\_Ca\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: TrSman\_C and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: TrSman\_C and Age Group (Imputed Data)

| **age\_group** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| 18-36 | 150.054 | 0.557 | 2,007 | 148.963 | 151.146 |
| 37-54 | 156.268 | 0.579 | 2,007 | 155.133 | 157.402 |
| 55-72 | 157.133 | 1.288 | 2,007 | 154.607 | 159.659 |

TrSman\_Ca\_em2 <- pairs(TrSman\_Ca\_em, adjust="Tukey")  
TrSman\_Ca\_em3 <- as.data.frame(TrSman\_Ca\_em2)  
  
TrSman\_Ca\_em3$signif <- with(TrSman\_Ca\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
TrSman\_Ca\_em3$p.value <- formatC(TrSman\_Ca\_em3$p.value, format = "e")  
  
TrSman\_Ca\_em2

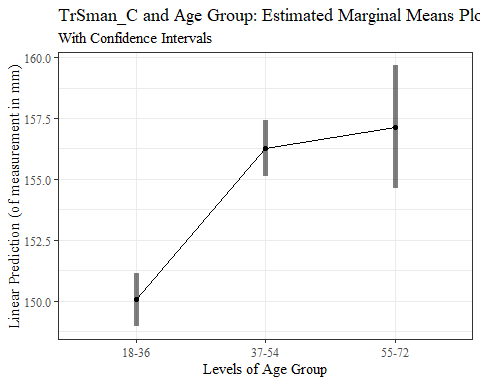
## contrast estimate SE df t.ratio p.value  
## (18-36) - (37-54) -6.213 0.513 2007 -12.106 <.0001  
## (18-36) - (55-72) -7.079 1.276 2007 -5.549 <.0001  
## (37-54) - (55-72) -0.865 1.280 2007 -0.676 0.7774  
##   
## Results are averaged over the levels of: gender, race\_eth   
## P value adjustment: tukey method for comparing a family of 3 estimates

TrSman\_Ca\_em3 <- TrSman\_Ca\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrSman\_Ca\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: TrSman\_C and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: TrSman\_C and Age Group (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (18-36) - (37-54) | -6.213 | 0.513 | 2,007 | -12.106 | 4.6484e-11 | TRUE |
| (18-36) - (55-72) | -7.079 | 1.276 | 2,007 | -5.549 | 9.7485e-08 | TRUE |
| (37-54) - (55-72) | -0.865 | 1.280 | 2,007 | -0.676 | 7.7742e-01 | FALSE |

emmip\_TrSman\_Ca <- emmip(TrSman\_Cout, ~ age\_group, CIs = TRUE)  
  
emmip\_TrSman\_Ca +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="TrSman\_C and Age Group: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Age Group")



TrTr\_Cout <- aov(TrTr\_C ~ gender+race\_eth+age\_group, data=chosen\_imputed1)  
summary(TrTr\_Cout)

## Df Sum Sq Mean Sq F value Pr(>F)   
## gender 1 103936 103936 744.27 < 2e-16 \*\*\*  
## race\_eth 4 20447 5112 36.60 < 2e-16 \*\*\*  
## age\_group 2 2058 1029 7.37 0.000647 \*\*\*  
## Residuals 2007 280276 140   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 1 observation deleted due to missingness

TrTr\_Cout\_data <- as.data.frame(tidy(TrTr\_Cout))

TrTr\_Cout\_data <- rename(TrTr\_Cout\_data, f.statistic = statistic)  
TrTr\_Cout\_data$signif <- with(TrTr\_Cout\_data, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
TrTr\_Cout\_data$p.value <- formatC(TrTr\_Cout\_data$p.value, format = "e")  
  
  
  
TrTr\_Cout\_data <- TrTr\_Cout\_data %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
#Autofit Width Table TNR  
flextable(TrTr\_Cout\_data) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("TrTr\_C Additive Anova Model Findings (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : TrTr\_C Additive Anova Model Findings (Imputed Data)

| **term** | **df** | **sumsq** | **meansq** | **f.statistic** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| gender | 1 | 103,936.133 | 103,936.133 | 744.266 | 1.1729e-139 | TRUE |
| race\_eth | 4 | 20,446.597 | 5,111.649 | 36.604 | 1.4226e-29 | TRUE |
| age\_group | 2 | 2,058.334 | 1,029.167 | 7.370 | 6.4728e-04 | TRUE |
| Residuals | 2,007 | 280,275.841 | 139.649 |  | NA |  |

TrTr\_Cg\_em <- emmeans(TrTr\_Cout, ~ gender)  
TrTr\_Cg\_em1 <- as.data.frame(TrTr\_Cg\_em)  
  
TrTr\_Cg\_em

## gender emmean SE df lower.CL upper.CL  
## Female/Other 276.4 0.7026 2007 275.0 277.8  
## Male 290.8 0.6943 2007 289.4 292.2  
##   
## Results are averaged over the levels of: race\_eth, age\_group   
## Confidence level used: 0.95

TrTr\_Cg\_em1 <- TrTr\_Cg\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrTr\_Cg\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: TrTr\_C and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: TrTr\_C and Gender (Imputed Data)

| **gender** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Female/Other | 276.408 | 0.703 | 2,007 | 275.030 | 277.786 |
| Male | 290.796 | 0.694 | 2,007 | 289.434 | 292.157 |

TrTr\_Cg\_em2 <- pairs(TrTr\_Cg\_em, adjust="Tukey")  
TrTr\_Cg\_em3 <- as.data.frame(TrTr\_Cg\_em2)  
  
TrTr\_Cg\_em3$signif <- with(TrTr\_Cg\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
TrTr\_Cg\_em3$p.value <- formatC(TrTr\_Cg\_em3$p.value, format = "e")  
  
TrTr\_Cg\_em2

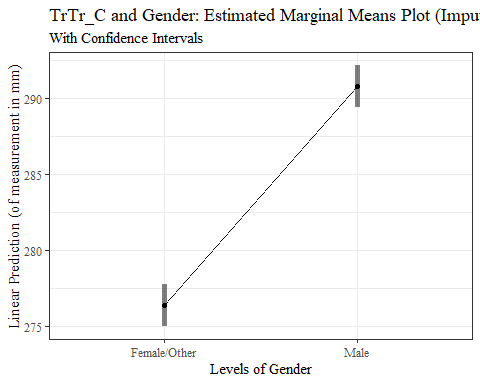
## contrast estimate SE df t.ratio p.value  
## (Female/Other) - Male -14.4 0.53 2007 -27.130 <.0001  
##   
## Results are averaged over the levels of: race\_eth, age\_group

TrTr\_Cg\_em3 <- TrTr\_Cg\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrTr\_Cg\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: TrTr\_C and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: TrTr\_C and Gender (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (Female/Other) - Male | -14.388 | 0.53 | 2,007 | -27.13 | 2.3722e-138 | TRUE |

emmip\_TrTr\_Cg <- emmip(TrTr\_Cout, ~ gender, CIs = TRUE)  
  
emmip\_TrTr\_Cg +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="TrTr\_C and Gender: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Gender")



TrTr\_Cr\_em <- emmeans(TrTr\_Cout, ~ race\_eth)  
TrTr\_Cr\_em1 <- as.data.frame(TrTr\_Cr\_em)  
  
TrTr\_Cr\_em

## race\_eth emmean SE df lower.CL upper.CL  
## Asian 281.7 1.3021 2007 279.2 284.3  
## Black 289.4 0.6347 2007 288.1 290.6  
## LatinX 281.9 1.2494 2007 279.5 284.4  
## Other 282.6 1.9409 2007 278.8 286.4  
## white 282.4 0.5120 2007 281.4 283.4  
##   
## Results are averaged over the levels of: gender, age\_group   
## Confidence level used: 0.95

TrTr\_Cr\_em1 <- TrTr\_Cr\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrTr\_Cr\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: TrTr\_C and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: TrTr\_C and Race/Ethnicity (Imputed Data)

| **race\_eth** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Asian | 281.723 | 1.302 | 2,007 | 279.170 | 284.277 |
| Black | 289.374 | 0.635 | 2,007 | 288.129 | 290.619 |
| LatinX | 281.905 | 1.249 | 2,007 | 279.455 | 284.356 |
| Other | 282.612 | 1.941 | 2,007 | 278.806 | 286.419 |
| white | 282.394 | 0.512 | 2,007 | 281.390 | 283.398 |

TrTr\_Cr\_em2 <- pairs(TrTr\_Cr\_em, adjust="Tukey")  
TrTr\_Cr\_em3 <- as.data.frame(TrTr\_Cr\_em2)  
  
TrTr\_Cr\_em3$signif <- with(TrTr\_Cr\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
TrTr\_Cr\_em3$p.value <- formatC(TrTr\_Cr\_em3$p.value, format = "e")  
  
TrTr\_Cr\_em2

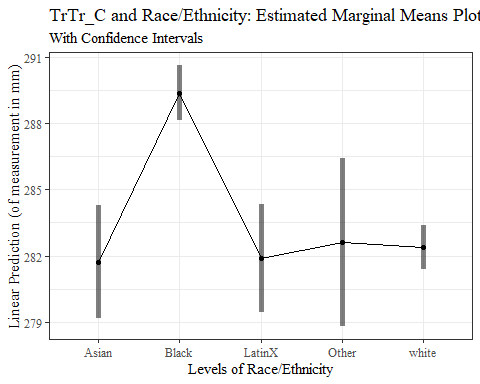
## contrast estimate SE df t.ratio p.value  
## Asian - Black -7.651 1.340 2007 -5.709 <.0001  
## Asian - LatinX -0.182 1.716 2007 -0.106 1.0000  
## Asian - Other -0.889 2.285 2007 -0.389 0.9952  
## Asian - white -0.671 1.285 2007 -0.522 0.9852  
## Black - LatinX 7.468 1.292 2007 5.782 <.0001  
## Black - Other 6.761 1.985 2007 3.406 0.0060  
## Black - white 6.980 0.607 2007 11.496 <.0001  
## LatinX - Other -0.707 2.257 2007 -0.313 0.9979  
## LatinX - white -0.488 1.235 2007 -0.396 0.9948  
## Other - white 0.218 1.948 2007 0.112 1.0000  
##   
## Results are averaged over the levels of: gender, age\_group   
## P value adjustment: tukey method for comparing a family of 5 estimates

TrTr\_Cr\_em3 <- TrTr\_Cr\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrTr\_Cr\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: TrTr\_C and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: TrTr\_C and Race/Ethnicity (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| Asian - Black | -7.651 | 1.340 | 2,007 | -5.709 | 1.3029e-07 | TRUE |
| Asian - LatinX | -0.182 | 1.716 | 2,007 | -0.106 | 9.9997e-01 | FALSE |
| Asian - Other | -0.889 | 2.285 | 2,007 | -0.389 | 9.9515e-01 | FALSE |
| Asian - white | -0.671 | 1.285 | 2,007 | -0.522 | 9.8517e-01 | FALSE |
| Black - LatinX | 7.468 | 1.292 | 2,007 | 5.782 | 8.5346e-08 | TRUE |
| Black - Other | 6.761 | 1.985 | 2,007 | 3.406 | 6.0459e-03 | TRUE |
| Black - white | 6.980 | 0.607 | 2,007 | 11.496 | 4.6485e-11 | TRUE |
| LatinX - Other | -0.707 | 2.257 | 2,007 | -0.313 | 9.9791e-01 | FALSE |
| LatinX - white | -0.488 | 1.235 | 2,007 | -0.396 | 9.9484e-01 | FALSE |
| Other - white | 0.218 | 1.948 | 2,007 | 0.112 | 9.9996e-01 | FALSE |

emmip\_TrTr\_Cr <- emmip(TrTr\_Cout, ~ race\_eth, CIs = TRUE)  
  
emmip\_TrTr\_Cr +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="TrTr\_C and Race/Ethnicity: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Race/Ethnicity")



TrTr\_Ca\_em <- emmeans(TrTr\_Cout, ~ age\_group)  
TrTr\_Ca\_em1 <- as.data.frame(TrTr\_Ca\_em)  
  
TrTr\_Ca\_em

## age\_group emmean SE df lower.CL upper.CL  
## 18-36 281.7 0.5867 2007 280.5 282.8  
## 37-54 283.1 0.6099 2007 281.9 284.3  
## 55-72 286.0 1.3578 2007 283.3 288.6  
##   
## Results are averaged over the levels of: gender, race\_eth   
## Confidence level used: 0.95

TrTr\_Ca\_em1 <- TrTr\_Ca\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrTr\_Ca\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: TrTr\_C and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: TrTr\_C and Age Group (Imputed Data)

| **age\_group** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| 18-36 | 281.682 | 0.587 | 2,007 | 280.532 | 282.833 |
| 37-54 | 283.146 | 0.610 | 2,007 | 281.950 | 284.342 |
| 55-72 | 285.977 | 1.358 | 2,007 | 283.314 | 288.640 |

TrTr\_Ca\_em2 <- pairs(TrTr\_Ca\_em, adjust="Tukey")  
TrTr\_Ca\_em3 <- as.data.frame(TrTr\_Ca\_em2)  
  
TrTr\_Ca\_em3$signif <- with(TrTr\_Ca\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
TrTr\_Ca\_em3$p.value <- formatC(TrTr\_Ca\_em3$p.value, format = "e")  
  
TrTr\_Ca\_em2

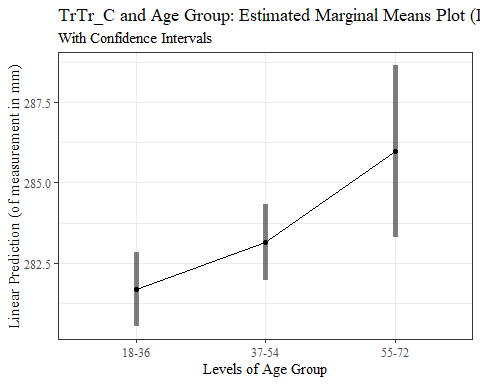
## contrast estimate SE df t.ratio p.value  
## (18-36) - (37-54) -1.46 0.541 2007 -2.705 0.0189  
## (18-36) - (55-72) -4.29 1.345 2007 -3.194 0.0041  
## (37-54) - (55-72) -2.83 1.349 2007 -2.098 0.0904  
##   
## Results are averaged over the levels of: gender, race\_eth   
## P value adjustment: tukey method for comparing a family of 3 estimates

TrTr\_Ca\_em3 <- TrTr\_Ca\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrTr\_Ca\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: TrTr\_C and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: TrTr\_C and Age Group (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (18-36) - (37-54) | -1.464 | 0.541 | 2,007 | -2.705 | 1.8855e-02 | TRUE |
| (18-36) - (55-72) | -4.295 | 1.345 | 2,007 | -3.194 | 4.0689e-03 | TRUE |
| (37-54) - (55-72) | -2.831 | 1.349 | 2,007 | -2.098 | 9.0424e-02 | FALSE |

emmip\_TrTr\_Ca <- emmip(TrTr\_Cout, ~ age\_group, CIs = TRUE)  
  
emmip\_TrTr\_Ca +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="TrTr\_C and Age Group: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Age Group")



TrTr\_Lout <- aov(TrTr\_L ~ gender+race\_eth+age\_group, data=chosen\_imputed1)  
summary(TrTr\_Lout)

## Df Sum Sq Mean Sq F value Pr(>F)   
## gender 1 46080 46080 1354.733 < 2e-16 \*\*\*  
## race\_eth 4 2880 720 21.165 < 2e-16 \*\*\*  
## age\_group 2 506 253 7.433 0.000608 \*\*\*  
## Residuals 2007 68267 34   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
## 1 observation deleted due to missingness

TrTr\_Lout\_data <- as.data.frame(tidy(TrTr\_Lout))

TrTr\_Lout\_data <- rename(TrTr\_Lout\_data, f.statistic = statistic)  
TrTr\_Lout\_data$signif <- with(TrTr\_Lout\_data, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
TrTr\_Lout\_data$p.value <- formatC(TrTr\_Lout\_data$p.value, format = "e")  
  
TrTr\_Lout\_data <- TrTr\_Lout\_data %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
#Autofit Width Table TNR  
flextable(TrTr\_Lout\_data) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("TrTr\_L Additive Anova Model Findings (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : TrTr\_L Additive Anova Model Findings (Imputed Data)

| **term** | **df** | **sumsq** | **meansq** | **f.statistic** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| gender | 1 | 46,080.224 | 46,080.224 | 1,354.733 | 4.4437e-227 | TRUE |
| race\_eth | 4 | 2,879.698 | 719.925 | 21.165 | 4.0967e-17 | TRUE |
| age\_group | 2 | 505.649 | 252.825 | 7.433 | 6.0789e-04 | TRUE |
| Residuals | 2,007 | 68,266.594 | 34.014 |  | NA |  |

TrTr\_Lg\_em <- emmeans(TrTr\_Lout, ~ gender)  
TrTr\_Lg\_em1 <- as.data.frame(TrTr\_Lg\_em)  
  
TrTr\_Lg\_em

## gender emmean SE df lower.CL upper.CL  
## Female/Other 142.9 0.3467 2007 142.2 143.5  
## Male 152.4 0.3427 2007 151.7 153.1  
##   
## Results are averaged over the levels of: race\_eth, age\_group   
## Confidence level used: 0.95

TrTr\_Lg\_em1 <- TrTr\_Lg\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrTr\_Lg\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: TrTr\_L and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: TrTr\_L and Gender (Imputed Data)

| **gender** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Female/Other | 142.857 | 0.347 | 2,007 | 142.177 | 143.537 |
| Male | 152.420 | 0.343 | 2,007 | 151.748 | 153.092 |

TrTr\_Lg\_em2 <- pairs(TrTr\_Lg\_em, adjust="Tukey")  
TrTr\_Lg\_em3 <- as.data.frame(TrTr\_Lg\_em2)  
  
TrTr\_Lg\_em3$signif <- with(TrTr\_Lg\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
TrTr\_Lg\_em3$p.value <- formatC(TrTr\_Lg\_em3$p.value, format = "e")  
  
TrTr\_Lg\_em2

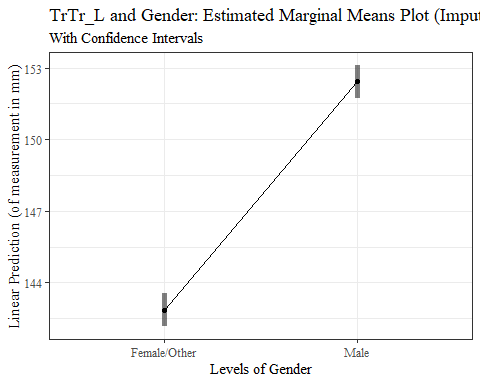
## contrast estimate SE df t.ratio p.value  
## (Female/Other) - Male -9.56 0.262 2007 -36.539 <.0001  
##   
## Results are averaged over the levels of: race\_eth, age\_group

TrTr\_Lg\_em3 <- TrTr\_Lg\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrTr\_Lg\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: TrTr\_L and Gender (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: TrTr\_L and Gender (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (Female/Other) - Male | -9.563 | 0.262 | 2,007 | -36.539 | 1.6050e-224 | TRUE |

emmip\_TrTr\_Lg <- emmip(TrTr\_Lout, ~ gender, CIs = TRUE)  
  
emmip\_TrTr\_Lg +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="TrTr\_L and Gender: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Gender")



TrTr\_Lr\_em <- emmeans(TrTr\_Lout, ~ race\_eth)  
TrTr\_Lr\_em1 <- as.data.frame(TrTr\_Lr\_em)  
  
TrTr\_Lr\_em

## race\_eth emmean SE df lower.CL upper.CL  
## Asian 147.6 0.6426 2007 146.3 148.8  
## Black 149.1 0.3132 2007 148.5 149.7  
## LatinX 147.4 0.6166 2007 146.2 148.6  
## Other 147.7 0.9579 2007 145.8 149.6  
## white 146.4 0.2527 2007 145.9 146.9  
##   
## Results are averaged over the levels of: gender, age\_group   
## Confidence level used: 0.95

TrTr\_Lr\_em1 <- TrTr\_Lr\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrTr\_Lr\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: TrTr\_L and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: TrTr\_L and Race/Ethnicity (Imputed Data)

| **race\_eth** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| Asian | 147.574 | 0.643 | 2,007 | 146.313 | 148.834 |
| Black | 149.106 | 0.313 | 2,007 | 148.492 | 149.721 |
| LatinX | 147.395 | 0.617 | 2,007 | 146.186 | 148.604 |
| Other | 147.712 | 0.958 | 2,007 | 145.833 | 149.590 |
| white | 146.407 | 0.253 | 2,007 | 145.911 | 146.902 |

TrTr\_Lr\_em2 <- pairs(TrTr\_Lr\_em, adjust="Tukey")  
TrTr\_Lr\_em3 <- as.data.frame(TrTr\_Lr\_em2)  
  
TrTr\_Lr\_em3$signif <- with(TrTr\_Lr\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
TrTr\_Lr\_em3$p.value <- formatC(TrTr\_Lr\_em3$p.value, format = "e")  
  
TrTr\_Lr\_em2

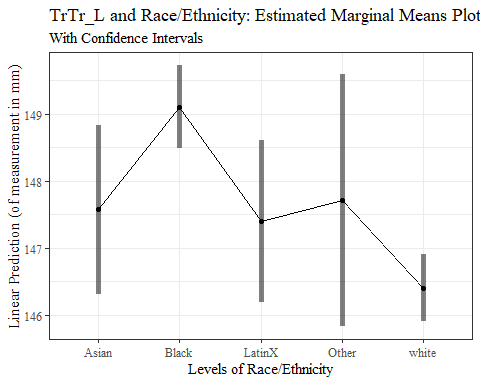
## contrast estimate SE df t.ratio p.value  
## Asian - Black -1.533 0.661 2007 -2.317 0.1397  
## Asian - LatinX 0.179 0.847 2007 0.211 0.9996  
## Asian - Other -0.138 1.128 2007 -0.122 0.9999  
## Asian - white 1.167 0.634 2007 1.840 0.3508  
## Black - LatinX 1.711 0.637 2007 2.685 0.0566  
## Black - Other 1.395 0.980 2007 1.423 0.6125  
## Black - white 2.700 0.300 2007 9.009 <.0001  
## LatinX - Other -0.317 1.114 2007 -0.284 0.9986  
## LatinX - white 0.988 0.609 2007 1.622 0.4837  
## Other - white 1.305 0.962 2007 1.357 0.6553  
##   
## Results are averaged over the levels of: gender, age\_group   
## P value adjustment: tukey method for comparing a family of 5 estimates

TrTr\_Lr\_em3 <- TrTr\_Lr\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrTr\_Lr\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: TrTr\_L and Race/Ethnicity (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: TrTr\_L and Race/Ethnicity (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| Asian - Black | -1.533 | 0.661 | 2,007 | -2.317 | 1.3973e-01 | FALSE |
| Asian - LatinX | 0.179 | 0.847 | 2,007 | 0.211 | 9.9956e-01 | FALSE |
| Asian - Other | -0.138 | 1.128 | 2,007 | -0.122 | 9.9995e-01 | FALSE |
| Asian - white | 1.167 | 0.634 | 2,007 | 1.840 | 3.5085e-01 | FALSE |
| Black - LatinX | 1.711 | 0.637 | 2,007 | 2.685 | 5.6587e-02 | FALSE |
| Black - Other | 1.395 | 0.980 | 2,007 | 1.423 | 6.1253e-01 | FALSE |
| Black - white | 2.700 | 0.300 | 2,007 | 9.009 | 4.6528e-11 | TRUE |
| LatinX - Other | -0.317 | 1.114 | 2,007 | -0.284 | 9.9857e-01 | FALSE |
| LatinX - white | 0.988 | 0.609 | 2,007 | 1.622 | 4.8365e-01 | FALSE |
| Other - white | 1.305 | 0.962 | 2,007 | 1.357 | 6.5530e-01 | FALSE |

emmip\_TrTr\_Lr <- emmip(TrTr\_Lout, ~ race\_eth, CIs = TRUE)  
  
emmip\_TrTr\_Lr +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="TrTr\_L and Race/Ethnicity: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Race/Ethnicity")



TrTr\_La\_em <- emmeans(TrTr\_Lout, ~ age\_group)  
TrTr\_La\_em1 <- as.data.frame(TrTr\_La\_em)  
  
TrTr\_La\_em

## age\_group emmean SE df lower.CL upper.CL  
## 18-36 146.7 0.2895 2007 146.1 147.3  
## 37-54 147.5 0.3010 2007 146.9 148.1  
## 55-72 148.7 0.6701 2007 147.4 150.0  
##   
## Results are averaged over the levels of: gender, race\_eth   
## Confidence level used: 0.95

TrTr\_La\_em1 <- TrTr\_La\_em1 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrTr\_La\_em1) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Estimated Marginal Means: TrTr\_L and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Estimated Marginal Means: TrTr\_L and Age Group (Imputed Data)

| **age\_group** | **emmean** | **SE** | **df** | **lower.CL** | **upper.CL** |
| --- | --- | --- | --- | --- | --- |
| 18-36 | 146.715 | 0.290 | 2,007 | 146.148 | 147.283 |
| 37-54 | 147.511 | 0.301 | 2,007 | 146.921 | 148.101 |
| 55-72 | 148.689 | 0.670 | 2,007 | 147.375 | 150.003 |

TrTr\_La\_em2 <- pairs(TrTr\_La\_em, adjust="Tukey")  
TrTr\_La\_em3 <- as.data.frame(TrTr\_La\_em2)  
  
TrTr\_La\_em3$signif <- with(TrTr\_La\_em3, ifelse(p.value < 0.05, 'TRUE', 'FALSE'))  
TrTr\_La\_em3$p.value <- formatC(TrTr\_La\_em3$p.value, format = "e")  
  
TrTr\_La\_em2

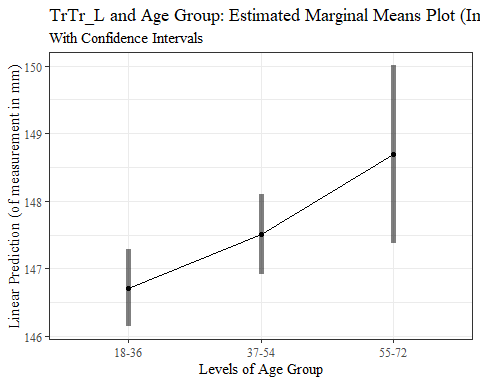
## contrast estimate SE df t.ratio p.value  
## (18-36) - (37-54) -0.796 0.267 2007 -2.980 0.0082  
## (18-36) - (55-72) -1.974 0.664 2007 -2.974 0.0083  
## (37-54) - (55-72) -1.178 0.666 2007 -1.769 0.1803  
##   
## Results are averaged over the levels of: gender, race\_eth   
## P value adjustment: tukey method for comparing a family of 3 estimates

TrTr\_La\_em3 <- TrTr\_La\_em3 %>%   
 mutate(across(where(is.numeric), round, digits=3))  
  
flextable(TrTr\_La\_em3) %>%  
 my\_ft\_theme()%>%   
 bold(part = "header") %>%   
 set\_caption("Tukey Pairwise Comparisons: TrTr\_L and Age Group (Imputed Data)") %>%   
 fit\_to\_width(7.5) %>%   
 autofit()

**Table** : Tukey Pairwise Comparisons: TrTr\_L and Age Group (Imputed Data)

| **contrast** | **estimate** | **SE** | **df** | **t.ratio** | **p.value** | **signif** |
| --- | --- | --- | --- | --- | --- | --- |
| (18-36) - (37-54) | -0.796 | 0.267 | 2,007 | -2.980 | 8.1969e-03 | TRUE |
| (18-36) - (55-72) | -1.974 | 0.664 | 2,007 | -2.974 | 8.3491e-03 | TRUE |
| (37-54) - (55-72) | -1.178 | 0.666 | 2,007 | -1.769 | 1.8025e-01 | FALSE |

emmip\_TrTr\_La <- emmip(TrTr\_Lout, ~ age\_group, CIs = TRUE)  
  
emmip\_TrTr\_La +   
 theme\_bw()+theme(text=element\_text(family= "Times New Roman"))+  
 labs(title="TrTr\_L and Age Group: Estimated Marginal Means Plot (Imputed Data)",  
 subtitle="With Confidence Intervals",  
 y="Linear Prediction (of measurement in mm)",  
 x="Levels of Age Group")



#gender   
AA\_Cg\_em1$measure <- "AA\_C"  
BiW\_Lg\_em1$measure <- "BiW\_L"  
BiW\_Cg\_em1$measure <- "BiW\_C"  
GoSub\_Cg\_em1$measure <- "GoSub\_C"  
NRB\_Lg\_em1$measure <- "NRB\_L"  
ProS\_Lg\_em1$measure <- "ProS\_L"  
SelP\_Lg\_em1$measure <- "SelP\_L"  
SelM\_Lg\_em1$measure <- "SelM\_L"  
SnasM\_Cg\_em1$measure <- "SnasM\_C"  
TrSman\_Cg\_em1$measure <- "TrSman\_C"  
TrTr\_Cg\_em1$measure <- "TrTr\_C"  
TrTr\_Lg\_em1$measure <- "TrTr\_L"  
  
gender\_means\_data1 <- rbind(AA\_Cg\_em1, BiW\_Lg\_em1, BiW\_Cg\_em1, GoSub\_Cg\_em1, NRB\_Lg\_em1,  
 ProS\_Lg\_em1, SelP\_Lg\_em1, SelM\_Lg\_em1, SnasM\_Cg\_em1, TrSman\_Cg\_em1,  
 TrTr\_Cg\_em1, TrTr\_Lg\_em1)  
  
#write\_xlsx(gender\_means\_data1, "C:\\Users\\19177\\OneDrive - Colostate\\Desktop\\Dissertation\\headscan\_dissertation\\gender\_means\_data1.xlsx")

#race\_eth  
AA\_Cr\_em1$measure <- "AA\_C"  
BiW\_Lr\_em1$measure <- "BiW\_L"  
BiW\_Cr\_em1$measure <- "BiW\_C"  
GoSub\_Cr\_em1$measure <- "GoSub\_C"  
NRB\_Lr\_em1$measure <- "NRB\_L"  
ProS\_Lr\_em1$measure <- "ProS\_L"  
SelP\_Lr\_em1$measure <- "SelP\_L"  
SelM\_Lr\_em1$measure <- "SelM\_L"  
SnasM\_Cr\_em1$measure <- "SnasM\_C"  
TrSman\_Cr\_em1$measure <- "TrSman\_C"  
TrTr\_Cr\_em1$measure <- "TrTr\_C"  
TrTr\_Lr\_em1$measure <- "TrTr\_L"  
  
race\_means\_data1 <- rbind(AA\_Cr\_em1, BiW\_Lr\_em1, BiW\_Cr\_em1, GoSub\_Cr\_em1, NRB\_Lr\_em1,  
 ProS\_Lr\_em1, SelP\_Lr\_em1, SelM\_Lr\_em1, SnasM\_Cr\_em1, TrSman\_Cr\_em1,  
 TrTr\_Cr\_em1, TrTr\_Lr\_em1)  
  
#write\_xlsx(race\_means\_data1, "C:\\Users\\19177\\OneDrive - Colostate\\Desktop\\Dissertation\\headscan\_dissertation\\race\_means\_data1.xlsx")

#age   
AA\_Ca\_em1$measure <- "AA\_C"  
BiW\_La\_em1$measure <- "BiW\_L"  
GoSub\_Ca\_em1$measure <- "GoSub\_C"  
ProS\_La\_em1$measure <- "ProS\_L"  
SelP\_La\_em1$measure <- "SelP\_L"  
SelM\_La\_em1$measure <- "SelM\_L"  
TrSman\_Ca\_em1$measure <- "TrSman\_C"  
TrTr\_Ca\_em1$measure <- "TrTr\_C"  
TrTr\_La\_em1$measure <- "TrTr\_L"  
  
age\_means\_data1 <- rbind(AA\_Ca\_em1, BiW\_La\_em1, GoSub\_Ca\_em1,  
 ProS\_La\_em1, SelP\_La\_em1, SelM\_La\_em1, TrSman\_Ca\_em1,  
 TrTr\_Ca\_em1, TrTr\_La\_em1)  
  
#write\_xlsx(age\_means\_data1, "C:\\Users\\19177\\OneDrive - Colostate\\Desktop\\Dissertation\\headscan\_dissertation\\age\_means\_data1.xlsx")

#gender   
AA\_Cg\_em3$measure <- "AA\_C"  
BiW\_Lg\_em3$measure <- "BiW\_L"  
BiW\_Cg\_em3$measure <- "BiW\_C"  
GoSub\_Cg\_em3$measure <- "GoSub\_C"  
NRB\_Lg\_em3$measure <- "NRB\_L"  
ProS\_Lg\_em3$measure <- "ProS\_L"  
SelP\_Lg\_em3$measure <- "SelP\_L"  
SelM\_Lg\_em3$measure <- "SelM\_L"  
SnasM\_Cg\_em3$measure <- "SnasM\_C"  
TrSman\_Cg\_em3$measure <- "TrSman\_C"  
TrTr\_Cg\_em3$measure <- "TrTr\_C"  
TrTr\_Lg\_em3$measure <- "TrTr\_L"  
  
gender\_est\_data1 <- rbind(AA\_Cg\_em3, BiW\_Lg\_em3, BiW\_Cg\_em3, GoSub\_Cg\_em3, NRB\_Lg\_em3,  
 ProS\_Lg\_em3, SelP\_Lg\_em3, SelM\_Lg\_em3, SnasM\_Cg\_em3, TrSman\_Cg\_em3,  
 TrTr\_Cg\_em3, TrTr\_Lg\_em3)  
  
#write\_xlsx(gender\_est\_data1, "C:\\Users\\19177\\OneDrive - Colostate\\Desktop\\Dissertation\\headscan\_dissertation\\gender\_est\_data1.xlsx")

#race\_eth  
AA\_Cr\_em3$measure <- "AA\_C"  
BiW\_Lr\_em3$measure <- "BiW\_L"  
BiW\_Cr\_em3$measure <- "BiW\_C"  
GoSub\_Cr\_em3$measure <- "GoSub\_C"  
NRB\_Lr\_em3$measure <- "NRB\_L"  
ProS\_Lr\_em3$measure <- "ProS\_L"  
SelP\_Lr\_em3$measure <- "SelP\_L"  
SelM\_Lr\_em3$measure <- "SelM\_L"  
SnasM\_Cr\_em3$measure <- "SnasM\_C"  
TrSman\_Cr\_em3$measure <- "TrSman\_C"  
TrTr\_Cr\_em3$measure <- "TrTr\_C"  
TrTr\_Lr\_em3$measure <- "TrTr\_L"  
  
race\_est\_data1 <- rbind(AA\_Cr\_em3, BiW\_Lr\_em3, BiW\_Cr\_em3, GoSub\_Cr\_em3, NRB\_Lr\_em3,  
 ProS\_Lr\_em3, SelP\_Lr\_em3, SelM\_Lr\_em3, SnasM\_Cr\_em3, TrSman\_Cr\_em3,  
 TrTr\_Cr\_em3, TrTr\_Lr\_em3)  
  
#write\_xlsx(race\_est\_data1, "C:\\Users\\19177\\OneDrive - Colostate\\Desktop\\Dissertation\\headscan\_dissertation\\race\_est\_data1.xlsx")

#age   
AA\_Ca\_em3$measure <- "AA\_C"  
BiW\_La\_em3$measure <- "BiW\_L"  
GoSub\_Ca\_em3$measure <- "GoSub\_C"  
ProS\_La\_em3$measure <- "ProS\_L"  
SelP\_La\_em3$measure <- "SelP\_L"  
SelM\_La\_em3$measure <- "SelM\_L"  
TrSman\_Ca\_em3$measure <- "TrSman\_C"  
TrTr\_Ca\_em3$measure <- "TrTr\_C"  
TrTr\_La\_em3$measure <- "TrTr\_L"  
  
age\_est\_data1 <- rbind(AA\_Ca\_em3, BiW\_La\_em3, GoSub\_Ca\_em3,  
 ProS\_La\_em3, SelP\_La\_em3, SelM\_La\_em3,   
 TrSman\_Ca\_em3, TrTr\_Ca\_em3, TrTr\_La\_em3)  
  
#write\_xlsx(age\_est\_data1, "C:\\Users\\19177\\OneDrive - Colostate\\Desktop\\Dissertation\\headscan\_dissertation\\age\_est\_data1.xlsx")