

Supplementary Material

Shining the Light on the MotionWatch8 Light Sensor for Sleep and Aging Research: What Can We Measure and What Are We Missing?

Supplementary Material 1. Statistical Analyses and Output

RSF

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Set-up and processing

```
if (!require("pacman")) install.packages("pacman")

## Loading required package: pacman

## Warning: package 'pacman' was built under R version 3.5.3

pacman::p_load(readxl,plyr,psych,Hmisc,pastecs,pROC,BlandAltmanLeh,scales,tableone)

setwd("C:/Users/rfalck/Desktop/Manuscripts/Light Meter Calibration")
light<-read_excel("Light Meter Data Final.xlsx")

spaceless <- function(x) {colnames(x) <- gsub(" ", "_", colnames(x));x}
light_spaceless <- spaceless(light)

light_spaceless<- rename(light_spaceless, c("Difference_(MW8_-_Lux)"="Difference", "MotionWatch_ID"="ID"))

#Indoor vs Outdoor
light_spaceless$indoor<-NA
light_spaceless$indoor[light_spaceless$Condition==1]<- 0
light_spaceless$indoor[light_spaceless$Condition==2]<- 1
light_spaceless$indoor[light_spaceless$Condition==3]<- 1
light_spaceless$indoor[light_spaceless$Condition == 4]<-0
light_spaceless$indoor[light_spaceless$Condition==5]<- 1
light_spaceless$indoor[light_spaceless$Condition==6]<- 1
light_spaceless$indoor[light_spaceless$Condition==7]<- 1
light_spaceless$indoor[light_spaceless$Condition==8]<- 1
light_spaceless$indoor[light_spaceless$Condition==9]<-0

#BLT box
light_spaceless$BLT_v1<-NA
light_spaceless$BLT_v1[light_spaceless$Condition==1]<- 0
light_spaceless$BLT_v1[light_spaceless$Condition==2]<- 1
light_spaceless$BLT_v1[light_spaceless$Condition==3]<- 0
```

```

light_spaceless$BLT_v1[light_spaceless$Condition == 4]<-0
light_spaceless$BLT_v1[light_spaceless$Condition==5]<- 0
light_spaceless$BLT_v1[light_spaceless$Condition==6]<- 0
light_spaceless$BLT_v1[light_spaceless$Condition==7]<- 0
light_spaceless$BLT_v1[light_spaceless$Condition==8]<- 0
light_spaceless$BLT_v1[light_spaceless$Condition==9]<-0

#BLT all (BLT box plus sunlight)
light_spaceless$BLT_v2<-NA
light_spaceless$BLT_v2[light_spaceless$Condition==1]<- 1
light_spaceless$BLT_v2[light_spaceless$Condition==2]<- 1
light_spaceless$BLT_v2[light_spaceless$Condition==3]<- 0
light_spaceless$BLT_v2[light_spaceless$Condition == 4]<-1
light_spaceless$BLT_v2[light_spaceless$Condition==5]<- 0
light_spaceless$BLT_v2[light_spaceless$Condition==6]<- 0
light_spaceless$BLT_v2[light_spaceless$Condition==7]<- 0
light_spaceless$BLT_v2[light_spaceless$Condition==8]<- 0
light_spaceless$BLT_v2[light_spaceless$Condition==9]<-1

#Light
light_spaceless$light<-NA
light_spaceless$light[light_spaceless$Condition==1]<- 1
light_spaceless$light[light_spaceless$Condition==2]<- 1
light_spaceless$light[light_spaceless$Condition==3]<- 1
light_spaceless$light[light_spaceless$Condition == 4]<-1
light_spaceless$light[light_spaceless$Condition==5]<- 1
light_spaceless$light[light_spaceless$Condition==6]<- 0
light_spaceless$light[light_spaceless$Condition==7]<- 1
light_spaceless$light[light_spaceless$Condition==8]<- 0
light_spaceless$light[light_spaceless$Condition==9]<-1

#Screen Time
light_spaceless$screen<-NA
light_spaceless$screen[light_spaceless$Condition==1]<- 0
light_spaceless$screen[light_spaceless$Condition==2]<- 0
light_spaceless$screen[light_spaceless$Condition==3]<- 0
light_spaceless$screen[light_spaceless$Condition == 4]<-0
light_spaceless$screen[light_spaceless$Condition==5]<- 1
light_spaceless$screen[light_spaceless$Condition==6]<- 0
light_spaceless$screen[light_spaceless$Condition==7]<- 1
light_spaceless$screen[light_spaceless$Condition==8]<- 1
light_spaceless$screen[light_spaceless$Condition==9]<-0

#Conditions
light_spaceless$Cond<-NA
light_spaceless$Cond[light_spaceless$Condition==1]<- "Morning Light"
light_spaceless$Cond[light_spaceless$Condition==2]<- "BLT Box"

```

```

light_spaceless$Cond[light_spaceless$Condition==3]<- "Indoor Light"
light_spaceless$Cond[light_spaceless$Condition == 4]<- "Mid-day Light"
light_spaceless$Cond[light_spaceless$Condition==5]<- "Computer Screen"
light_spaceless$Cond[light_spaceless$Condition==6]<- "Dark Room"
light_spaceless$Cond[light_spaceless$Condition==7]<- "Smart Phone"
light_spaceless$Cond[light_spaceless$Condition==8]<- "Dark + Smart"
light_spaceless$Cond[light_spaceless$Condition==9]<- "Evening Light"

```

Lux Values by Condition and Sleeves versus No Sleeves

```
vars<-dput(names(light_spaceless[c(5,6)]))
```

```
## c("MW8_Lux", "Luxometer")
```

```
Table1_reduced<-CreateTableOne(vars=vars, strata=c("Cond"),light_spaceless)
print(Table1_reduced,exact=catVars,contDigits=1,missing=TRUE,quote=TRUE)
```

```

##           "Stratified by Cond"
## ""           "BLT Box"           "Computer Screen" "Dark + Smart"
## "n"           " 80"              " 80"              " 80"
## "MW8_Lux (mean (SD))" "104.0 (49.5)" "112.0 (63.5)"    "48.2 (76.3)"
## "Luxometer (mean (SD))" "115.6 (12.1)" "134.3 (10.2)"    "58.3 (104.6)"
##           "Stratified by Cond"
## ""           "Dark Room"         "Evening Light"   "Indoor Light"
## "n"           " 40"              " 80"              " 80"
## "MW8_Lux (mean (SD))" "11.4 (5.7)"   "282.2 (577.1)"   "71.9 (28.9)"
## "Luxometer (mean (SD))" " 0.5 (0.5)"   "345.7 (306.9)"   "88.2 (11.1)"
##           "Stratified by Cond"
## ""           "Mid-day Light"       "Morning Light"
## "n"           " 80"              " 80"
## "MW8_Lux (mean (SD))" " 62524.9 (49265.6)" "21736.9 (19321.1)"
## "Luxometer (mean (SD))" "102699.8 (16690.2)" "87991.5 (29051.0)"
##           "Stratified by Cond"
## ""           "Smart Phone" "p"           "test" "Missing"
## "n"           " 80"              ""            ""      ""
## "MW8_Lux (mean (SD))" "64.1 (34.2)" "<0.001" ""      "0.0"
## "Luxometer (mean (SD))" "89.7 (12.6)" "<0.001" ""      "0.0"

```

```
Table1_grouped<-CreateTableOne(vars=vars, strata=c("Sleeves", "Cond"),light_s
paceless)
```

```
## Warning in StdDiff(variable = var, group = strataVar): Variable has only
## NA's in at least one stratum. na.rm turned off.
```

```
## Warning in StdDiff(variable = var, group = strataVar): Variable has only
## NA's in at least one stratum. na.rm turned off.
```

```
print(Table1_grouped,exact=catVars,contDigits=1,missing=TRUE,quote=TRUE)
```

```

##           "Stratified by Sleeves:Cond"
## ""           "0:BLT Box"           "1:BLT Box"
## "n"           " 40"              " 40"

```

```

## "MW8_Lux (mean (SD))" "138.2 (31.6)" " 69.8 (39.6)"
## "Luxometer (mean (SD))" "120.3 (11.0)" "110.8 (11.3)"
## "Stratified by Sleeves:Cond"
## "" "0:Computer Screen" "1:Computer Screen"
## "n" " 40" " 40"
## "MW8_Lux (mean (SD))" "146.0 (40.2)" " 78.0 (64.7)"
## "Luxometer (mean (SD))" "130.0 (9.6)" "138.5 (9.1)"
## "Stratified by Sleeves:Cond"
## "" "0:Dark + Smart" "1:Dark + Smart" "0:Dark Room"
## "n" " 40" " 40" "0"
## "MW8_Lux (mean (SD))" " 82.5 (96.3)" "13.9 (10.4)" "- "
## "Luxometer (mean (SD))" "115.8 (124.0)" " 0.8 (0.4)" "- "
## "Stratified by Sleeves:Cond"
## "" "1:Dark Room" "0:Evening Light"
## "n" "0" " 40"
## "MW8_Lux (mean (SD))" "- " "468.2 (749.1)"
## "Luxometer (mean (SD))" "- " "467.2 (344.6)"
## "Stratified by Sleeves:Cond"
## "" "1:Evening Light" "0:Indoor Light"
## "n" " 40" " 40"
## "MW8_Lux (mean (SD))" " 96.2 (205.8)" "84.4 (29.9)"
## "Luxometer (mean (SD))" "224.3 (204.2)" "88.6 (13.9)"
## "Stratified by Sleeves:Cond"
## "" "1:Indoor Light" "0:Mid-day Light"
## "n" " 40" " 40"
## "MW8_Lux (mean (SD))" "59.4 (21.8)" " 86720.3 (44255.8)"
## "Luxometer (mean (SD))" "87.9 (7.5)" "100694.0 (17451.5)"
## "Stratified by Sleeves:Cond"
## "" "1:Mid-day Light" "0:Morning Light"
## "n" " 40" " 40"
## "MW8_Lux (mean (SD))" " 38329.5 (41916.6)" "18670.8 (10568.4)"
## "Luxometer (mean (SD))" "104705.5 (15857.6)" "87578.8 (32350.0)"
## "Stratified by Sleeves:Cond"
## "" "1:Morning Light" "0:Smart Phone"
## "n" " 40" " 40"
## "MW8_Lux (mean (SD))" "24803.1 (25004.1)" "75.2 (30.2)"
## "Luxometer (mean (SD))" "88404.2 (25742.7)" "90.8 (13.3)"
## "Stratified by Sleeves:Cond"
## "" "1:Smart Phone" "p" "test" "Missing"
## "n" " 40" "" "" ""
## "MW8_Lux (mean (SD))" "53.0 (34.6)" "<0.001" "" "0.0"
## "Luxometer (mean (SD))" "88.6 (11.8)" "<0.001" "" "0.0"

```

#T-tests by group (Sleeves versus no Sleeves)

```
t.test(MW8_Lux~Sleeves, data=light_spaceless, subset = Condition == 1)
```

```

##
## Welch Two Sample t-test
##
## data: MW8_Lux by Sleeves

```

```

## t = -1.4287, df = 52.504, p-value = 0.159
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -14743.149 2478.485
## sample estimates:
## mean in group 0 mean in group 1
## 18670.77 24803.10

t.test(MW8_Lux~Sleeves, data=light_spaceless, subset = Condition == 2)

##
## Welch Two Sample t-test
##
## data: MW8_Lux by Sleeves
## t = 8.5443, df = 74.333, p-value = 1.17e-12
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## 52.48913 84.41224
## sample estimates:
## mean in group 0 mean in group 1
## 138.23137 69.78069

t.test(MW8_Lux~Sleeves, data=light_spaceless, subset = Condition == 3)

##
## Welch Two Sample t-test
##
## data: MW8_Lux by Sleeves
## t = 4.2661, df = 71.289, p-value = 6.015e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## 13.28648 36.60228
## sample estimates:
## mean in group 0 mean in group 1
## 84.35069 59.40631

t.test(MW8_Lux~Sleeves, data=light_spaceless, subset = Condition == 4)

##
## Welch Two Sample t-test
##
## data: MW8_Lux by Sleeves
## t = 5.0209, df = 77.771, p-value = 3.19e-06
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## 29202.26 67579.30
## sample estimates:
## mean in group 0 mean in group 1
## 86720.30 38329.52

t.test(MW8_Lux~Sleeves, data=light_spaceless, subset = Condition == 5)

```

```

##
## Welch Two Sample t-test
##
## data: MW8_Lux by Sleeves
## t = 5.6383, df = 65.23, p-value = 3.977e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## 43.87976 92.00936
## sample estimates:
## mean in group 0 mean in group 1
## 145.98919 78.04462

t.test(MW8_Lux~Sleeves, data=light_spaceless, subset = Condition == 7)

##
## Welch Two Sample t-test
##
## data: MW8_Lux by Sleeves
## t = 3.0493, df = 76.617, p-value = 0.003148
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## 7.68755 36.62970
## sample estimates:
## mean in group 0 mean in group 1
## 75.20381 53.04519

t.test(MW8_Lux~Sleeves, data=light_spaceless, subset = Condition == 8)

##
## Welch Two Sample t-test
##
## data: MW8_Lux by Sleeves
## t = 4.4772, df = 39.905, p-value = 6.181e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## 37.6268 99.5602
## sample estimates:
## mean in group 0 mean in group 1
## 82.47156 13.87806

t.test(MW8_Lux~Sleeves, data=light_spaceless, subset = Condition == 9)

##
## Welch Two Sample t-test
##
## data: MW8_Lux by Sleeves
## t = 3.0284, df = 44.855, p-value = 0.004068
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## 124.5681 619.4300
## sample estimates:

```

```

## mean in group 0 mean in group 1
##      468.23869      96.23964

#T-tests for MW8 Sleeves versus LT40
sleeves.1<-subset(light_spaceless, Condition==1 & Sleeves==1)
nosleeves.1<-subset(light_spaceless, Condition==1 & Sleeves==0)
sleeves.2<-subset(light_spaceless, Condition==2 & Sleeves==1)
nosleeves.2<-subset(light_spaceless, Condition==2 & Sleeves==0)
sleeves.3<-subset(light_spaceless, Condition==3 & Sleeves==1)
nosleeves.3<-subset(light_spaceless, Condition==3 & Sleeves==0)
sleeves.4<-subset(light_spaceless, Condition==4 & Sleeves==1)
nosleeves.4<-subset(light_spaceless, Condition==4 & Sleeves==0)
sleeves.5<-subset(light_spaceless, Condition==5 & Sleeves==1)
nosleeves.5<-subset(light_spaceless, Condition==5 & Sleeves==0)
nosleeves.6<-subset(light_spaceless, Condition==6)
sleeves.7<-subset(light_spaceless, Condition==7 & Sleeves==1)
nosleeves.7<-subset(light_spaceless, Condition==7 & Sleeves==0)
sleeves.8<-subset(light_spaceless, Condition==8 & Sleeves==1)
nosleeves.8<-subset(light_spaceless, Condition==8 & Sleeves==0)
sleeves.9<-subset(light_spaceless, Condition==9 & Sleeves==1)
nosleeves.9<-subset(light_spaceless, Condition==9 & Sleeves==0)

t.test(sleeves.1$MW8_Lux, sleeves.1$Luxometer, paired = TRUE)

##
## Paired t-test
##
## data: sleeves.1$MW8_Lux and sleeves.1$Luxometer
## t = -12.785, df = 39, p-value = 1.584e-15
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -73663.33 -53538.96
## sample estimates:
## mean of the differences
## -63601.15

t.test(nosleeves.1$MW8_Lux, nosleeves.1$Luxometer, paired = TRUE)

##
## Paired t-test
##
## data: nosleeves.1$MW8_Lux and nosleeves.1$Luxometer
## t = -13.711, df = 39, p-value < 2.2e-16
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -79073.22 -58742.73
## sample estimates:
## mean of the differences
## -68907.98

t.test(sleeves.2$MW8_Lux, sleeves.2$Luxometer, paired = TRUE)

```

```
##
## Paired t-test
##
## data: sleeves.2$MW8_Lux and sleeves.2$Luxometer
## t = -6.1102, df = 39, p-value = 3.641e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -54.66472 -27.47390
## sample estimates:
## mean of the differences
## -41.06931
```

```
t.test(nosleeves.2$MW8_Lux, nosleeves.2$Luxometer, paired = TRUE)
```

```
##
## Paired t-test
##
## data: nosleeves.2$MW8_Lux and nosleeves.2$Luxometer
## t = 3.396, df = 39, p-value = 0.001585
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## 7.230933 28.531817
## sample estimates:
## mean of the differences
## 17.88137
```

```
t.test(sleeves.3$MW8_Lux, sleeves.3$Luxometer, paired = TRUE)
```

```
##
## Paired t-test
##
## data: sleeves.3$MW8_Lux and sleeves.3$Luxometer
## t = -8.3436, df = 39, p-value = 3.314e-10
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -35.41059 -21.59179
## sample estimates:
## mean of the differences
## -28.50119
```

```
t.test(nosleeves.3$MW8_Lux, nosleeves.3$Luxometer, paired = TRUE)
```

```
##
## Paired t-test
##
## data: nosleeves.3$MW8_Lux and nosleeves.3$Luxometer
## t = -1.1856, df = 39, p-value = 0.2429
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -11.464717 2.991092
## sample estimates:
```



```

## mean of the differences
##           -4.236813

t.test(sleeves.4$MW8_Lux, sleeves.4$Luxometer, paired = TRUE)

##
## Paired t-test
##
## data: sleeves.4$MW8_Lux and sleeves.4$Luxometer
## t = -9.548, df = 39, p-value = 9.326e-12
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -80437.35 -52314.61
## sample estimates:
## mean of the differences
##           -66375.98

t.test(nosleeves.4$MW8_Lux, nosleeves.4$Luxometer, paired = TRUE)

##
## Paired t-test
##
## data: nosleeves.4$MW8_Lux and nosleeves.4$Luxometer
## t = -1.8838, df = 39, p-value = 0.06706
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -28977.429  1030.024
## sample estimates:
## mean of the differences
##           -13973.7

t.test(sleeves.5$MW8_Lux, sleeves.5$Luxometer, paired = TRUE)

##
## Paired t-test
##
## data: sleeves.5$MW8_Lux and sleeves.5$Luxometer
## t = -6.0716, df = 39, p-value = 4.118e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -80.61197 -40.32378
## sample estimates:
## mean of the differences
##           -60.46787

t.test(nosleeves.5$MW8_Lux, nosleeves.5$Luxometer, paired = TRUE)

##
## Paired t-test
##
## data: nosleeves.5$MW8_Lux and nosleeves.5$Luxometer
## t = 2.6768, df = 39, p-value = 0.01081

```

```

## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## 3.90298 28.04040
## sample estimates:
## mean of the differences
## 15.97169

t.test(nosleeves.6$MW8_Lux, nosleeves.6$Luxometer, paired = TRUE)

##
## Paired t-test
##
## data: nosleeves.6$MW8_Lux and nosleeves.6$Luxometer
## t = 11.843, df = 39, p-value = 1.724e-14
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## 9.041384 12.765741
## sample estimates:
## mean of the differences
## 10.90356

t.test(sleeves.7$MW8_Lux, sleeves.7$Luxometer, paired = TRUE)

##
## Paired t-test
##
## data: sleeves.7$MW8_Lux and sleeves.7$Luxometer
## t = -5.9761, df = 39, p-value = 5.591e-07
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -47.64913 -23.55050
## sample estimates:
## mean of the differences
## -35.59981

t.test(nosleeves.7$MW8_Lux, nosleeves.7$Luxometer, paired = TRUE)

##
## Paired t-test
##
## data: nosleeves.7$MW8_Lux and nosleeves.7$Luxometer
## t = -3.2704, df = 39, p-value = 0.00225
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -25.266449 -5.955927
## sample estimates:
## mean of the differences
## -15.61119

t.test(sleeves.8$MW8_Lux, sleeves.8$Luxometer, paired = TRUE)

```

```

##
## Paired t-test
##
## data: sleeves.8$MW8_Lux and sleeves.8$Luxometer
## t = 7.8939, df = 39, p-value = 1.312e-09
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  9.74748 16.46364
## sample estimates:
## mean of the differences
##                13.10556

t.test(nosleeves.8$MW8_Lux, nosleeves.8$Luxometer, paired = TRUE)

##
## Paired t-test
##
## data: nosleeves.8$MW8_Lux and nosleeves.8$Luxometer
## t = -2.542, df = 39, p-value = 0.01511
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -59.820744 -6.806131
## sample estimates:
## mean of the differences
##                -33.31344

t.test(sleeves.9$MW8_Lux, sleeves.9$Luxometer, paired = TRUE)

##
## Paired t-test
##
## data: sleeves.9$MW8_Lux and sleeves.9$Luxometer
## t = -3.6565, df = 39, p-value = 0.0007532
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -198.8430 -57.2027
## sample estimates:
## mean of the differences
##                -128.0229

t.test(nosleeves.9$MW8_Lux, nosleeves.9$Luxometer, paired = TRUE)

##
## Paired t-test
##
## data: nosleeves.9$MW8_Lux and nosleeves.9$Luxometer
## t = 0.010994, df = 39, p-value = 0.9913
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
## -197.8323 199.9946
## sample estimates:

```

```
## mean of the differences
##          1.081188
```

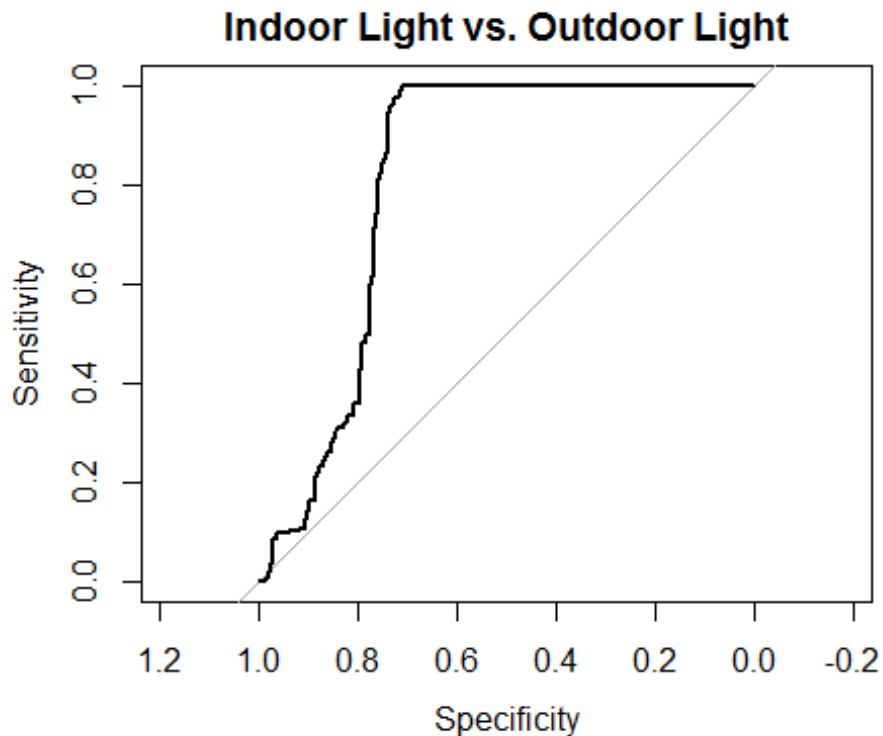
Diagnostic Accuracy of MW8 for determining indoor vs. outdoor light

```
indoor.roc<-roc(indoor ~ MW8_Lux , light_spaceless)
```

```
## Setting levels: control = 0, case = 1
```

```
## Setting direction: controls > cases
```

```
plot(indoor.roc, col = 1, lty = 1, main = "Indoor Light vs. Outdoor Light")
```



```
roc(light_spaceless$indoor, light_spaceless$MW8_Lux, ci=TRUE, of="auc", boot.
n=200, ci.alpha= 0.95,
    stratified=FALSE)
```

```
## Setting levels: control = 0, case = 1
```

```
## Setting direction: controls > cases
```

```
##
```

```
## Call:
```

```
## roc.default(response = light_spaceless$indoor, predictor = light_spaceless
$MW8_Lux,      ci = TRUE, of = "auc", boot.n = 200, ci.alpha = 0.95, stratifie
d = FALSE)
```

```
##
```

```
## Data: light_spaceless$MW8_Lux in 240 controls (light_spaceless$indoor 0) >
440 cases (light_spaceless$indoor 1).
```

```

## Area under the curve: 0.8118
## 95% CI: 0.7686-0.855 (DeLong)

##Best Fit Using Youden index##
coords(indoor.roc, "b", ret = "t", best.method= "youden")

## Warning in coords.roc(indoor.roc, "b", ret = "t", best.method = "youden"):
## An upcoming version of pROC will set the 'transpose' argument to FALSE
## by default. Set transpose = TRUE explicitly to keep the current behavior,
## or transpose = FALSE to adopt the new one and silence this warning. Type
## help(coords_transpose) for additional information.

## [1] 323.0337

coords(indoor.roc, 323.033, ret=c("accuracy", "specificity", "sensitivity", "t
hreshold", "ppv", "npv"))

## Warning in coords.roc(indoor.roc, 323.033, ret = c("accuracy",
## "specificity", : An upcoming version of pROC will set the 'transpose'
## argument to FALSE by default. Set transpose = TRUE explicitly to keep the
## current behavior, or transpose = FALSE to adopt the new one and silence
## this warning. Type help(coords_transpose) for additional information.

##   accuracy specificity sensitivity   threshold         ppv         npv
## 0.8985294  0.7125000  1.0000000 323.0330000  0.8644401  1.0000000

100+71.25-100#71.25

## [1] 71.25

```

Diagnostic Accuracy of MW8 for determining indoor vs. outdoor light

```

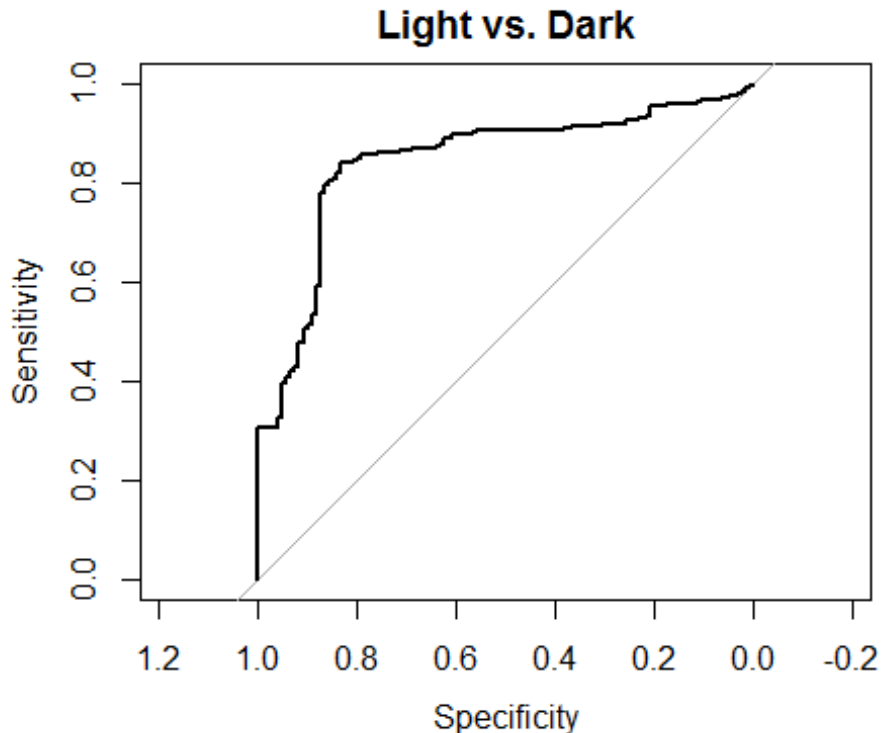
light.roc<-roc(light ~ MW8_Lux , light_spaceless)

## Setting levels: control = 0, case = 1

## Setting direction: controls < cases

plot(light.roc, col = 1, lty = 1, main = "Light vs. Dark")

```



```

roc(light_spaceless$light, light_spaceless$MW8_Lux, ci=TRUE, of="auc", boot.n
=200, ci.alpha= 0.95,
    stratified=FALSE)

## Setting levels: control = 0, case = 1
## Setting direction: controls < cases

##
## Call:
## roc.default(response = light_spaceless$light, predictor = light_spaceless$
MW8_Lux,      ci = TRUE, of = "auc", boot.n = 200, ci.alpha = 0.95, stratified
= FALSE)
##
## Data: light_spaceless$MW8_Lux in 120 controls (light_spaceless$light 0) <
560 cases (light_spaceless$light 1).
## Area under the curve: 0.8434
## 95% CI: 0.8065-0.8804 (DeLong)

##Best Fit Using Youden index##
coords(light.roc, "b", ret = "t", best.method= "youden")

## Warning in coords.roc(light.roc, "b", ret = "t", best.method = "youden"):
## An upcoming version of pROC will set the 'transpose' argument to FALSE
## by default. Set transpose = TRUE explicitly to keep the current behavior,
## or transpose = FALSE to adopt the new one and silence this warning. Type
## help(coords_transpose) for additional information.

## [1] 32.72375

```

```

coords(light.roc, 32.72375, ret=c("accuracy", "specificity", "sensitivity", "t
hreshold", "ppv", "npv"))

## Warning in coords.roc(light.roc, 32.72375, ret = c("accuracy",
## "specificity", : An upcoming version of pROC will set the 'transpose'
## argument to FALSE by default. Set transpose = TRUE explicitly to keep the
## current behavior, or transpose = FALSE to adopt the new one and silence
## this warning. Type help(coords_transpose) for additional information.

##   accuracy specificity sensitivity   threshold      ppv      npv
## 0.8397059  0.8333333  0.8410714  32.7237500  0.9592668  0.5291005

84.10714+83.3333333-100#67.44047

## [1] 67.44047

```

Diagnostic Accuracy of MW8 for determining Bright Light Box versus Other

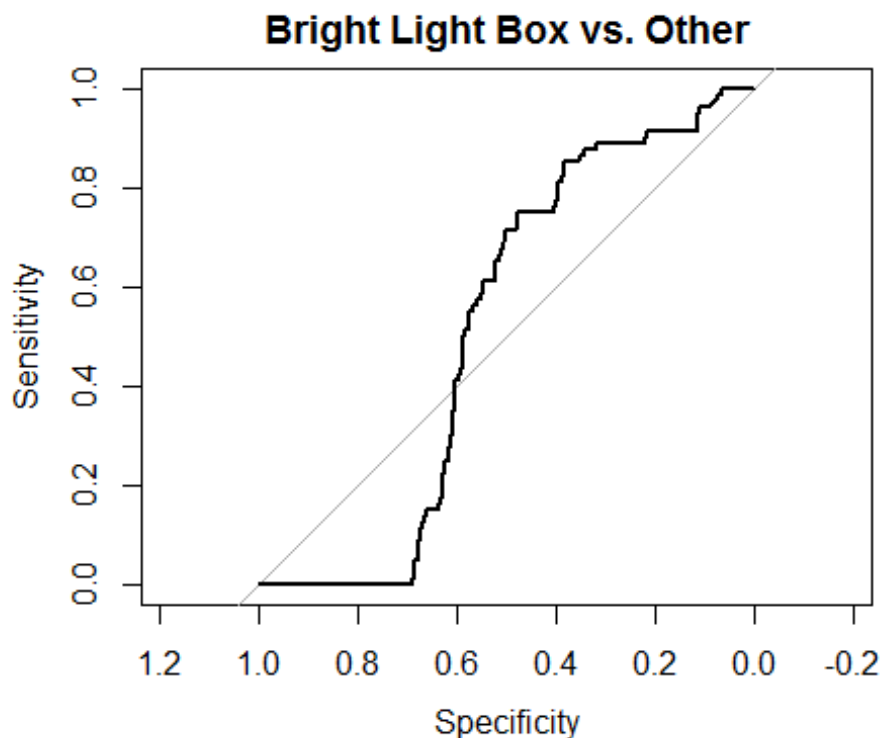
```

bltbox.roc<-roc(BLT_v1 ~ MW8_Lux , light_spaceless)

## Setting levels: control = 0, case = 1
## Setting direction: controls < cases

plot(bltbox.roc, col = 1, lty = 1, main = "Bright Light Box vs. Other")

```



```

roc(light_spaceless$BLT_v1, light_spaceless$MW8_Lux, ci=TRUE, of="auc", boot.
n=200, ci.alpha= 0.95,
    stratified=FALSE)

## Setting levels: control = 0, case = 1
## Setting direction: controls < cases

##
## Call:
## roc.default(response = light_spaceless$BLT_v1, predictor = light_spaceless
$MW8_Lux,      ci = TRUE, of = "auc", boot.n = 200, ci.alpha = 0.95, stratifie
d = FALSE)
##
## Data: light_spaceless$MW8_Lux in 600 controls (light_spaceless$BLT_v1 0) <
80 cases (light_spaceless$BLT_v1 1).
## Area under the curve: 0.5144
## 95% CI: 0.4655-0.5634 (DeLong)

##Best Fit Using Youden index##
coords(bltbox.roc, "b", ret = "t", best.method= "youden")

## Warning in coords.roc(bltbox.roc, "b", ret = "t", best.method = "youden"):
## An upcoming version of pROC will set the 'transpose' argument to FALSE
## by default. Set transpose = TRUE explicitly to keep the current behavior,
## or transpose = FALSE to adopt the new one and silence this warning. Type
## help(coords_transpose) for additional information.

## [1] 61.7875

coords(bltbox.roc, 61.7875, ret=c("accuracy", "specificity", "sensitivity", "t
hreshold", "ppv", "npv"))

## Warning in coords.roc(bltbox.roc, 61.7875, ret = c("accuracy",
## "specificity", : An upcoming version of pROC will set the 'transpose'
## argument to FALSE by default. Set transpose = TRUE explicitly to keep the
## current behavior, or transpose = FALSE to adopt the new one and silence
## this warning. Type help(coords_transpose) for additional information.

##      accuracy specificity sensitivity  threshold      ppv      npv
## 0.4411765  0.3866667  0.8500000  61.7875000  0.1559633  0.9508197

38.666667+85-100 #23.6667

## [1] 23.66667

```

Diagnostic Accuracy of MW8 for determining Screen Time versus Other

```

screen.roc<-roc(screen ~ MW8_Lux , light_spaceless)

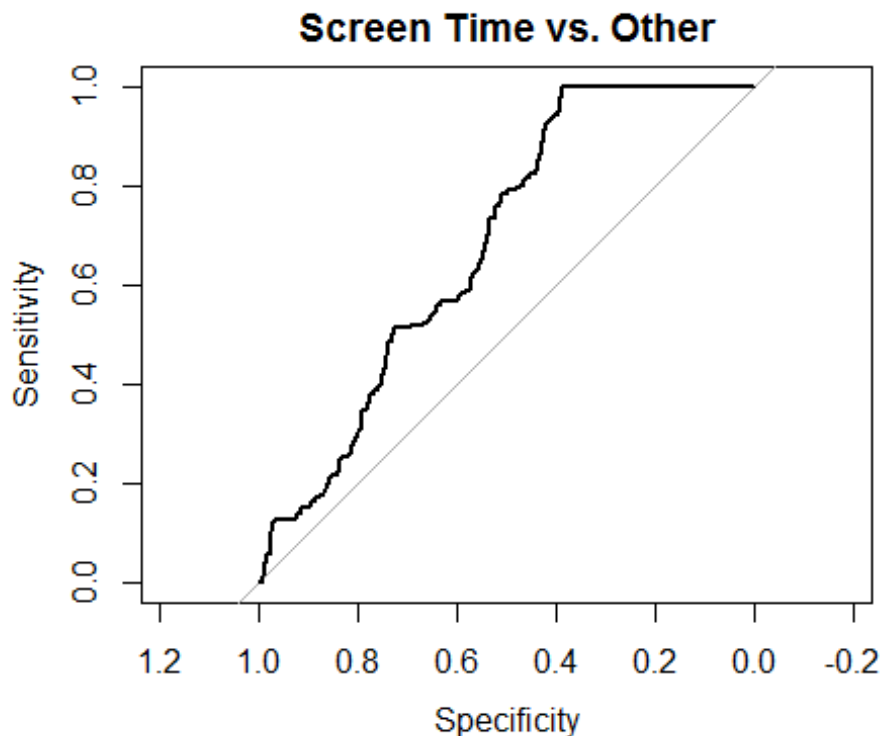
## Setting levels: control = 0, case = 1

## Setting direction: controls > cases

```



```
plot(screen.roc, col = 1, lty = 1, main = "Screen Time vs. Other")
```



```
roc(light_spaceless$screen, light_spaceless$MW8_Lux, ci=TRUE, of="auc", boot.
n=200, ci.alpha= 0.95,
    stratified=FALSE)

## Setting levels: control = 0, case = 1
## Setting direction: controls > cases

##
## Call:
## roc.default(response = light_spaceless$screen, predictor = light_spaceless
## $MW8_Lux,      ci = TRUE, of = "auc", boot.n = 200, ci.alpha = 0.95, stratifie
## d = FALSE)
##
## Data: light_spaceless$MW8_Lux in 440 controls (light_spaceless$screen 0) >
## 240 cases (light_spaceless$screen 1).
## Area under the curve: 0.6804
## 95% CI: 0.6413-0.7195 (DeLong)

##Best Fit Using Youden index##
coords(screen.roc, "b", ret = "t", best.method= "youden")

## Warning in coords.roc(screen.roc, "b", ret = "t", best.method = "youden"):
## An upcoming version of pROC will set the 'transpose' argument to FALSE
## by default. Set transpose = TRUE explicitly to keep the current behavior,
## or transpose = FALSE to adopt the new one and silence this warning. Type
## help(coords_transpose) for additional information.
```

```
## [1] 323.0337
coords(screen.roc, 323.0337, ret=c("accuracy", "specificity", "sensitivity", "
threshold", "ppv", "npv"))

## Warning in coords.roc(screen.roc, 323.0337, ret = c("accuracy",
## "specificity", : An upcoming version of pROC will set the 'transpose'
## argument to FALSE by default. Set transpose = TRUE explicitly to keep the
## current behavior, or transpose = FALSE to adopt the new one and silence
## this warning. Type help(coords_transpose) for additional information.

##      accuracy specificity sensitivity   threshold         ppv         npv
## 0.6044118 0.3886364 1.0000000 323.0337000 0.4715128 1.0000000

38.86364+100-100#38.86364

## [1] 38.86364
```

Bland Altman Plot

```
light_spaceless$Avg<- (light_spaceless$MW8_Lux+light_spaceless$Luxometer)/2

Upper<-mean(light_spaceless$Difference) + 2*sd(light_spaceless$Difference)
Lower<-mean(light_spaceless$Difference) - 2*sd(light_spaceless$Difference)
Average<- mean(light_spaceless$Difference)

light_spaceless$Sleeves[light_spaceless$Sleeves==1]<-"Sleeves"
light_spaceless$Sleeves[light_spaceless$Sleeves==0]<-"No Sleeves"
light_spaceless$Sleeves[is.na(light_spaceless$Sleeves)]<-"No Sleeves"

Bland.Plot<-ggplot(light_spaceless, aes(x=Avg, y=Difference, Group = Sleeves,
colour = Sleeves))+ geom_point()+ ylim(-150000, 120000) + xlim(0,150000) + sc
ale_x_continuous(labels= comma) +
  scale_y_continuous(labels = comma) + geom_hline(yintercept=Upper, linetype=
"dashed") + geom_hline(yintercept=Average, linetype="solid") +
  geom_hline(yintercept=Lower, linetype="dashed") + labs(x="Average Lux", y=
"Difference in Lux") +
  theme_bw() + theme(panel.border = element_blank(), panel.grid.major = eleme
nt_blank(), panel.grid.minor = element_blank(), axis.line = element_line(colou
r = "black"))

## Scale for 'x' is already present. Adding another scale for 'x', which
## will replace the existing scale.

## Scale for 'y' is already present. Adding another scale for 'y', which
## will replace the existing scale.

ggsave(Bland.Plot,height= 6, width= 12, file="BlandAltman.tiff",dpi=300)

Bland.Plot
```

