

Appendix

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```
cor(pre_covid_num)
```

```
##                               Student_Attendance_Year_2_Pct
## Student_Attendance_Year_2_Pct                1.00000000
## Teacher_Attendance_Year_2_Pct                 0.09082425
## Suspensions_Per_100_Students_Year_2_Pct      -0.61486384
## Misconducts_To_Suspensions_Year_2_Pct        -0.14451478
##                               Teacher_Attendance_Year_2_Pct
## Student_Attendance_Year_2_Pct                0.09082425
## Teacher_Attendance_Year_2_Pct                1.00000000
## Suspensions_Per_100_Students_Year_2_Pct      -0.06036052
## Misconducts_To_Suspensions_Year_2_Pct        -0.03518840
##                               Suspensions_Per_100_Students_Year_2_Pct
## Student_Attendance_Year_2_Pct                -0.61486384
## Teacher_Attendance_Year_2_Pct                -0.06036052
## Suspensions_Per_100_Students_Year_2_Pct       1.00000000
## Misconducts_To_Suspensions_Year_2_Pct         0.20391880
##                               Misconducts_To_Suspensions_Year_2_Pct
## Student_Attendance_Year_2_Pct                -0.1445148
## Teacher_Attendance_Year_2_Pct                -0.0351884
## Suspensions_Per_100_Students_Year_2_Pct       0.2039188
## Misconducts_To_Suspensions_Year_2_Pct         1.0000000
```

```
cor(post_covid_num)
```

```
##                               Student_Attendance_Year_2_Pct
## Student_Attendance_Year_2_Pct                1.00000000
## Teacher_Attendance_Year_2_Pct                 0.28228203
## Suspensions_Per_100_Students_Year_2_Pct      -0.64916121
## Misconducts_To_Suspensions_Year_2_Pct        -0.09092687
##                               Teacher_Attendance_Year_2_Pct
## Student_Attendance_Year_2_Pct                0.28228203
## Teacher_Attendance_Year_2_Pct                1.00000000
## Suspensions_Per_100_Students_Year_2_Pct      -0.07068021
## Misconducts_To_Suspensions_Year_2_Pct        -0.11753033
##                               Suspensions_Per_100_Students_Year_2_Pct
## Student_Attendance_Year_2_Pct                -0.64916121
## Teacher_Attendance_Year_2_Pct                -0.07068021
## Suspensions_Per_100_Students_Year_2_Pct       1.00000000
## Misconducts_To_Suspensions_Year_2_Pct         0.13797463
##                               Misconducts_To_Suspensions_Year_2_Pct
## Student_Attendance_Year_2_Pct                -0.09092687
## Teacher_Attendance_Year_2_Pct                -0.11753033
```

```
## Suspensions_Per_100_Students_Year_2_Pct 0.13797463
## Misconducts_To_Suspensions_Year_2_Pct 1.00000000
```

generally independent, with some higher correlation values for (suspensions and student attendance) and (suspensions and misconduct-to-suspensions)

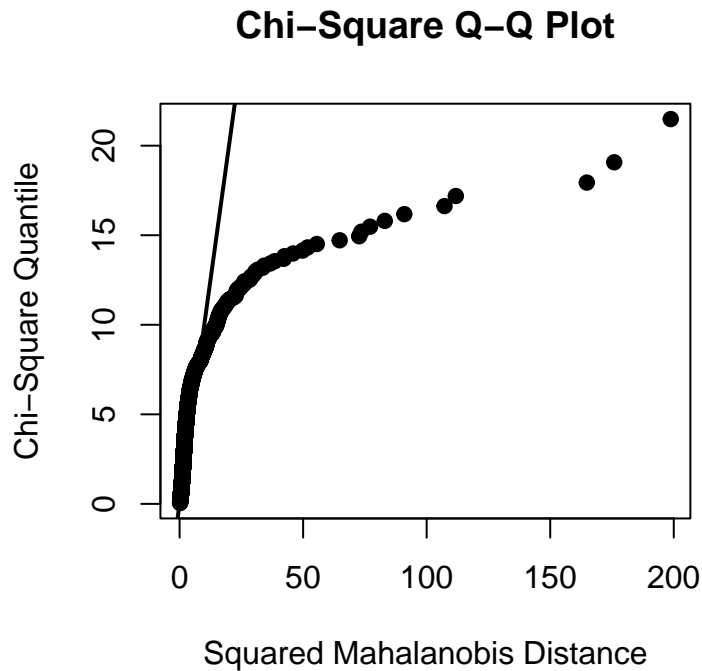


Figure 1: Multivariate QQ plot for pre covid data

```
# MVN
mvn_pre$multivariateNormality
```

```
##          Test          HZ p value MVN
## 1 Henze-Zirkler 90.40323          0 NO
```

```
# MVN
mvn_post$multivariateNormality
```

```
##          Test          HZ p value MVN
## 1 Henze-Zirkler 21.63475          0 NO
```

```
# PC selection
PCA_pre <- prcomp(pre_covid_num, scale = apply(pre_covid_num,sd))
summary(PCA_pre)
```

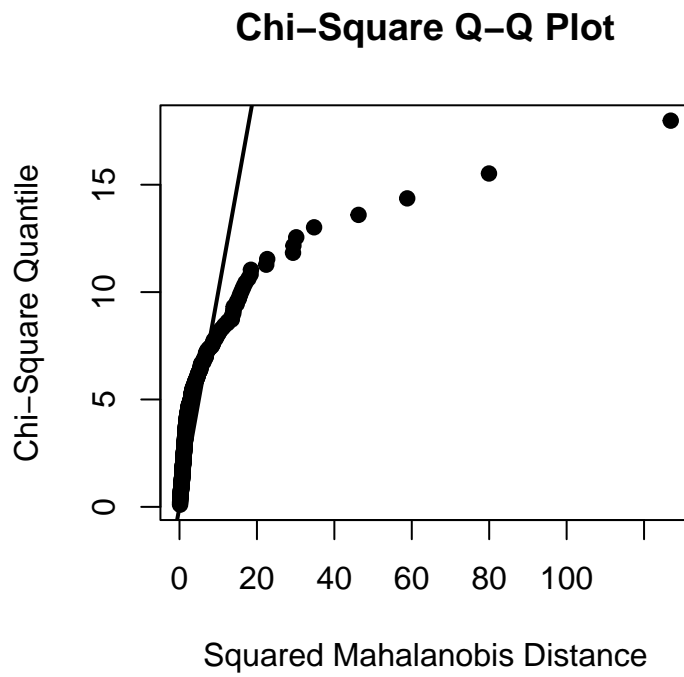


Figure 2: Multivariate QQ plot for post covid data

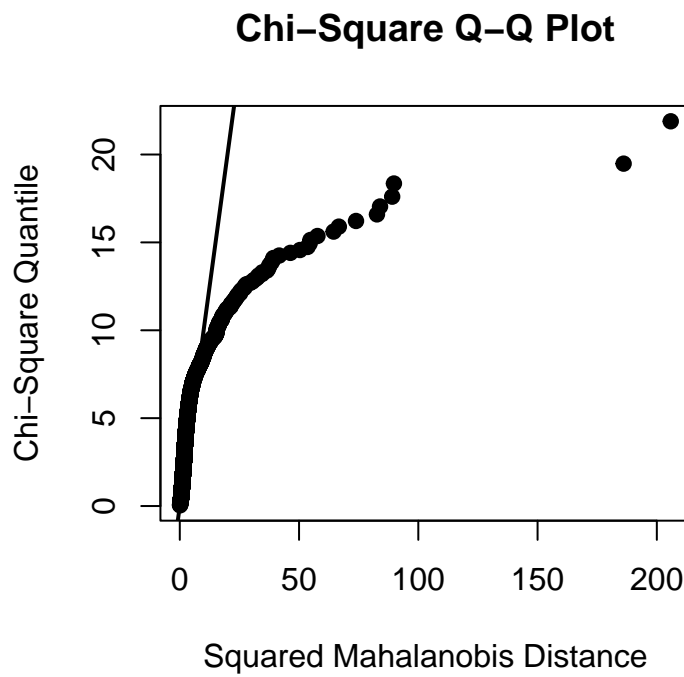


Figure 3: Multivariate QQ plot for all data

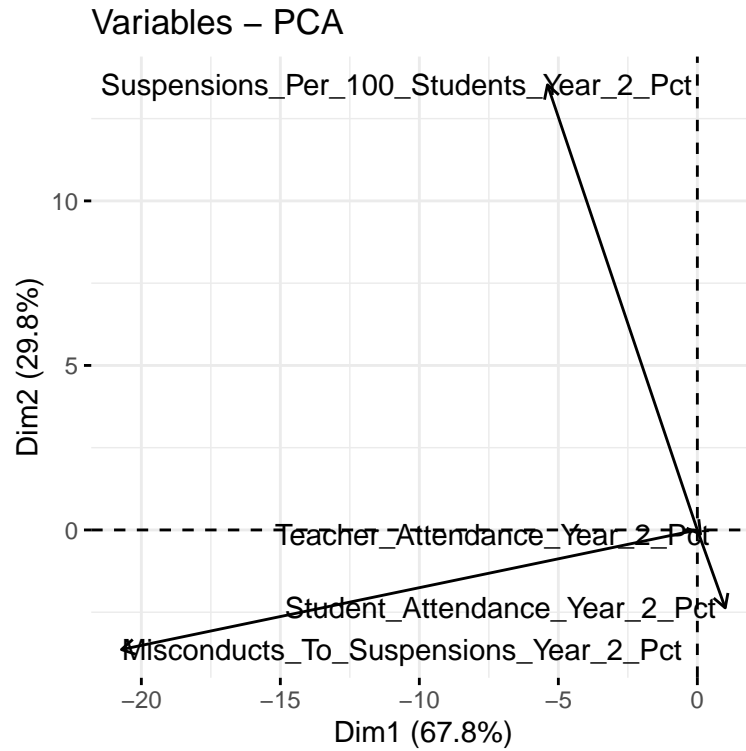


Figure 4: Biplot of variables for pre covid data's PCA

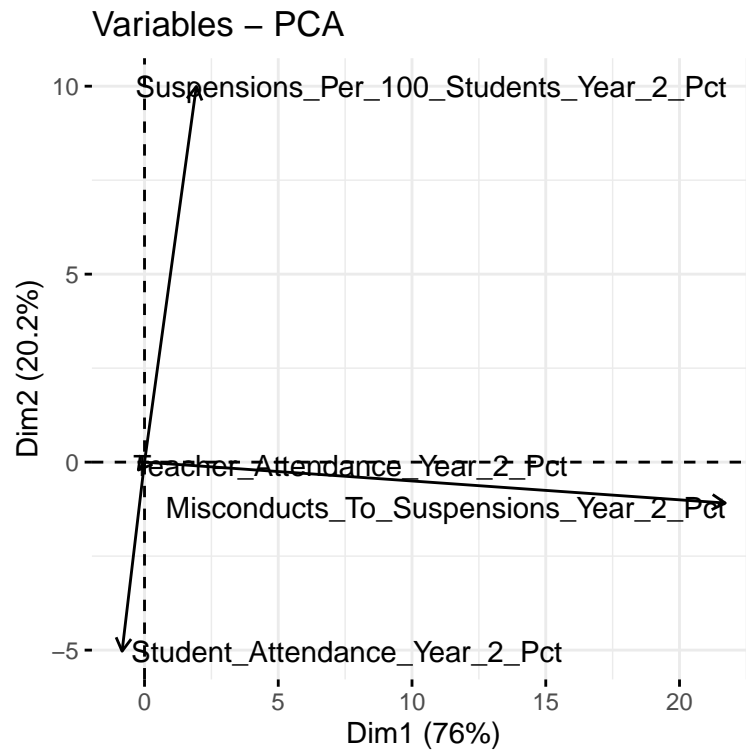


Figure 5: Biplot of variables for post covid data's PCA

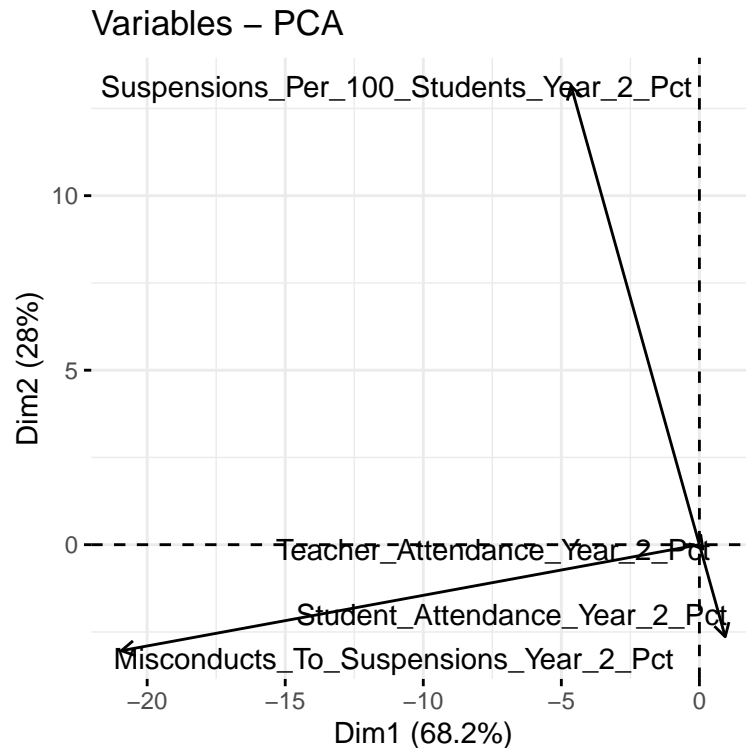


Figure 6: Biplot of variables for all data's PCA

```
## Importance of components:
##              PC1    PC2    PC3    PC4
## Standard deviation    1.3111 0.9917 0.9572 0.6174
## Proportion of Variance 0.4298 0.2459 0.2291 0.0953
## Cumulative Proportion 0.4298 0.6756 0.9047 1.0000
```

PC selection

```
PCA_post <- prcomp(post_covid_num, scale = apply(post_covid_num,sd))
summary(PCA_post)
```

```
## Importance of components:
##              PC1    PC2    PC3    PC4
## Standard deviation    1.3350 0.9995 0.9524 0.5582
## Proportion of Variance 0.4456 0.2498 0.2268 0.0779
## Cumulative Proportion 0.4456 0.6953 0.9221 1.0000
```

PC selection

```
PCA_all <- prcomp(all_data, scale = apply(all_data,sd))
summary(PCA_all)
```

```
## Importance of components:
##              PC1    PC2    PC3    PC4
## Standard deviation    1.2642 0.9890 0.9604 0.7081
## Proportion of Variance 0.3995 0.2445 0.2306 0.1253
## Cumulative Proportion 0.3995 0.6441 0.8747 1.0000
```

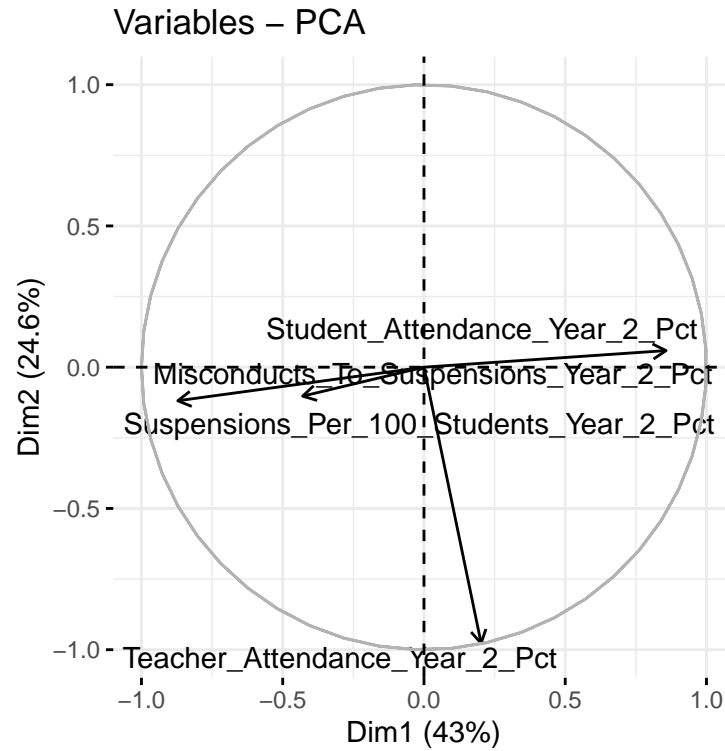


Figure 7: Biplot of variables for pre covid data's PCA when scaled by standard deviation

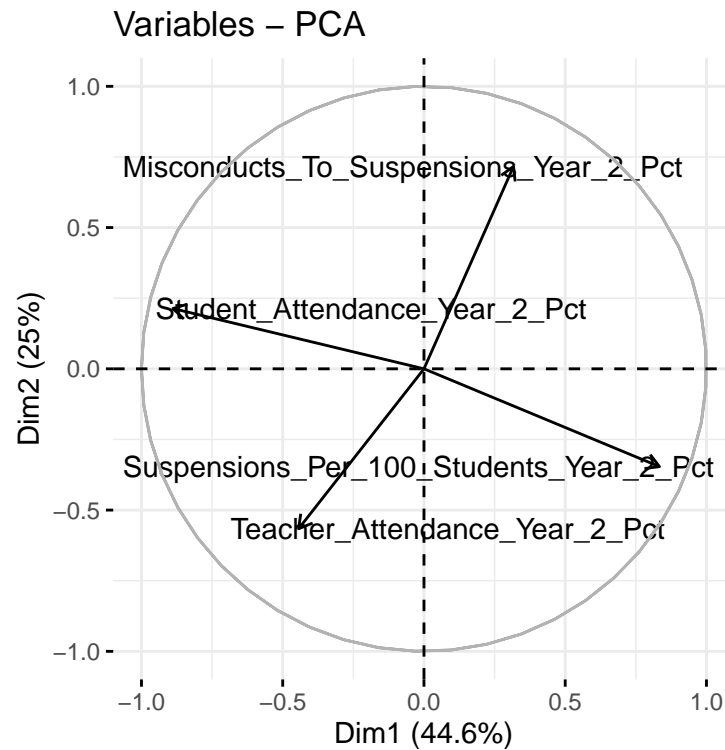


Figure 8: Biplot of variables for post covid data's PCA when scaled by standard deviation

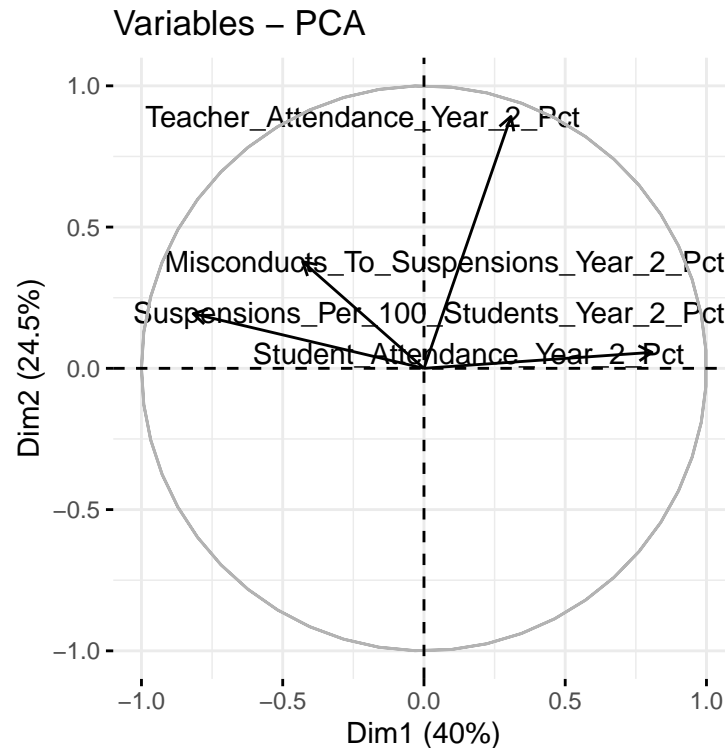


Figure 9: Biplot of variables for all data's PCA when scaled by standard deviation

```
# MANOVA with Wilks-Lambda test for pre covid data
mano_pre_PC <- manova( cbind(Suspensions_Per_100_Students_Year_2_Pct,
                             Misconducts_To_Suspensions_Year_2_Pct,
                             Teacher_Attendance_Year_2_Pct,
                             Student_Attendance_Year_2_Pct)
                      ~Primary_Category , data = box_pre)
summary(mano_pre_PC, test="Wilks")

##              Df  Wilks approx F num Df den Df    Pr(>F)
## Primary_Category    2  0.49464   207.24     8   3930 < 2.2e-16 ***
## Residuals          1968
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

# MANOVA with Wilks-Lambda test for post covid data
mano_post_PC <- manova( cbind(Suspensions_Per_100_Students_Year_2_Pct,
                              Misconducts_To_Suspensions_Year_2_Pct,
                              Teacher_Attendance_Year_2_Pct,
                              Student_Attendance_Year_2_Pct)
                       ~Primary_Category , data = box_post)
summary(mano_post_PC, test="Wilks")

##              Df  Wilks approx F num Df den Df    Pr(>F)
## Primary_Category    2  0.5848   30.459     8    792 < 2.2e-16 ***
## Residuals          399
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

#pre ANOVAs

```
summary.aov(mano_pre_PC)
```

```
## Response Suspensions_Per_100_Students_Year_2_Pct :
##              Df Sum Sq Mean Sq F value    Pr(>F)
## Primary_Category  2  93365   46682  282.76 < 2.2e-16 ***
## Residuals       1968 324906    165
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Response Misconducts_To_Suspensions_Year_2_Pct :
##              Df Sum Sq Mean Sq F value    Pr(>F)
## Primary_Category  2  17546   8773.0  20.219 2.033e-09 ***
## Residuals       1968 853930    433.9
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Response Teacher_Attendance_Year_2_Pct :
##              Df Sum Sq Mean Sq F value    Pr(>F)
## Primary_Category  2    10.3   5.1285  0.8069 0.4464
## Residuals       1968 12508.1   6.3558
##
## Response Student_Attendance_Year_2_Pct :
##              Df Sum Sq Mean Sq F value    Pr(>F)
## Primary_Category  2  15691   7845.6   980.6 < 2.2e-16 ***
## Residuals       1968  15746     8.0
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

#post ANOVAs

```
summary.aov(mano_post_PC)
```

```
## Response Suspensions_Per_100_Students_Year_2_Pct :
##              Df Sum Sq Mean Sq F value    Pr(>F)
## Primary_Category  2   7769   3884.4  43.747 < 2.2e-16 ***
## Residuals       399  35428    88.8
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Response Misconducts_To_Suspensions_Year_2_Pct :
##              Df Sum Sq Mean Sq F value    Pr(>F)
## Primary_Category  2    532   266.19  0.5621 0.5705
## Residuals       399 188951   473.56
##
## Response Teacher_Attendance_Year_2_Pct :
##              Df Sum Sq Mean Sq F value    Pr(>F)
## Primary_Category  2   110.43  55.216  17.142 7.213e-08 ***
## Residuals       399 1285.23    3.221
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```



```
##
## Response Student_Attendance_Year_2_Pct :
##           Df Sum Sq Mean Sq F value    Pr(>F)
## Primary_Category  2  6768.1  3384.0  133.43 < 2.2e-16 ***
## Residuals      399 10119.7    25.4
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#pre box plot
```

```
box_ta_pre <- ggplot(box_pre, aes(x = Primary_Category, y = Teacher_Attendance_Year_2_Pct)) +
  geom_boxplot()
box_sa_pre <- ggplot(box_pre, aes(x = Primary_Category, y = Student_Attendance_Year_2_Pct)) +
  geom_boxplot()
box_sus_pre <- ggplot(box_pre, aes(x = Primary_Category, y = Suspensions_Per_100_Students_Year_2_Pct)) +
  geom_boxplot()
box_mis_pre <- ggplot(box_pre, aes(x = Primary_Category, y = Misconducts_To_Suspensions_Year_2_Pct)) +
  geom_boxplot()
```

```
#post box plot
```

```
box_ta_post <- ggplot(box_post, aes(x = Primary_Category, y = Teacher_Attendance_Year_2_Pct)) +
  geom_boxplot()
box_sa_post <- ggplot(box_post, aes(x = Primary_Category, y = Student_Attendance_Year_2_Pct)) +
  geom_boxplot()
box_sus_post <- ggplot(box_post, aes(x = Primary_Category, y = Suspensions_Per_100_Students_Year_2_Pct)) +
  geom_boxplot()
box_mis_post <- ggplot(box_post, aes(x = Primary_Category, y = Misconducts_To_Suspensions_Year_2_Pct)) +
  geom_boxplot()
```

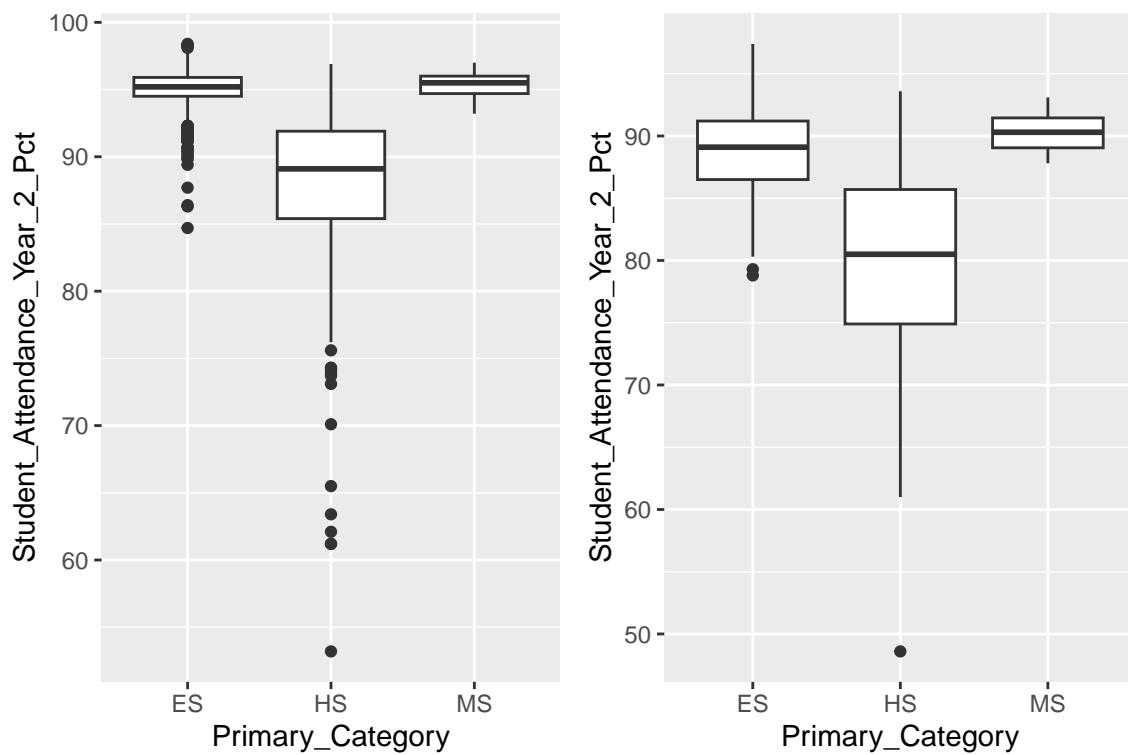


Figure 10: Box Plots of Student Attendance with pre covid on the left and post covid on the right

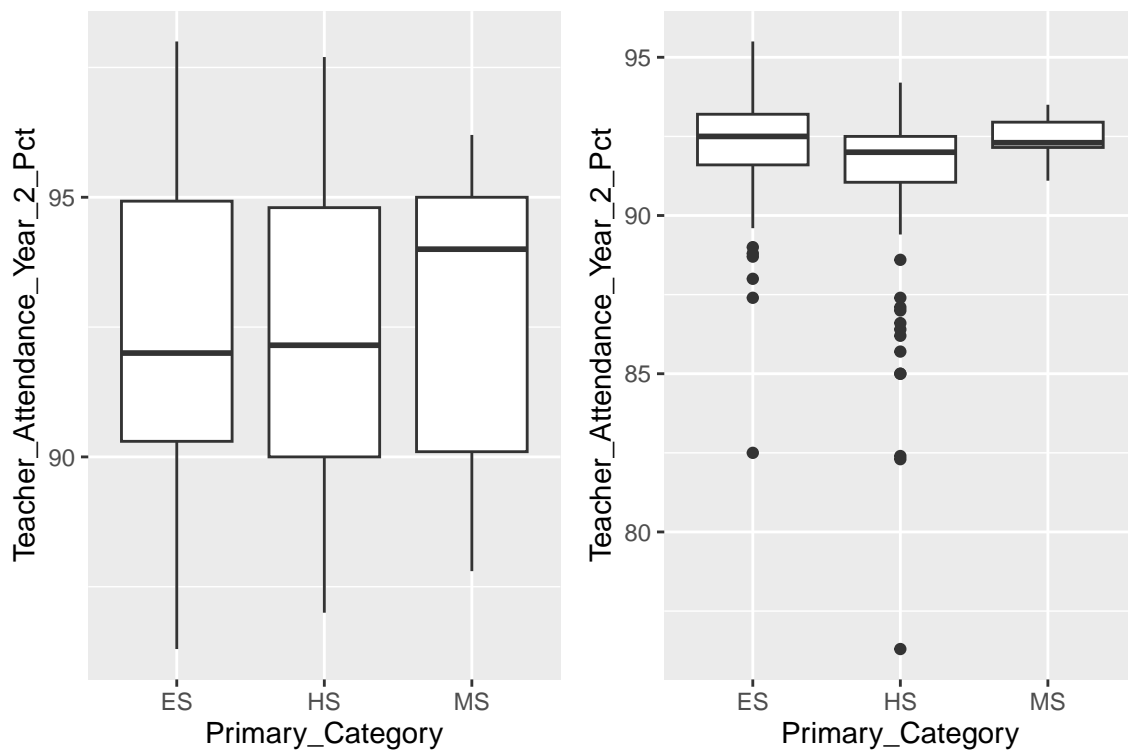


Figure 11: Box Plots of Teacher Attendance with pre covid on the left and post covid on the right

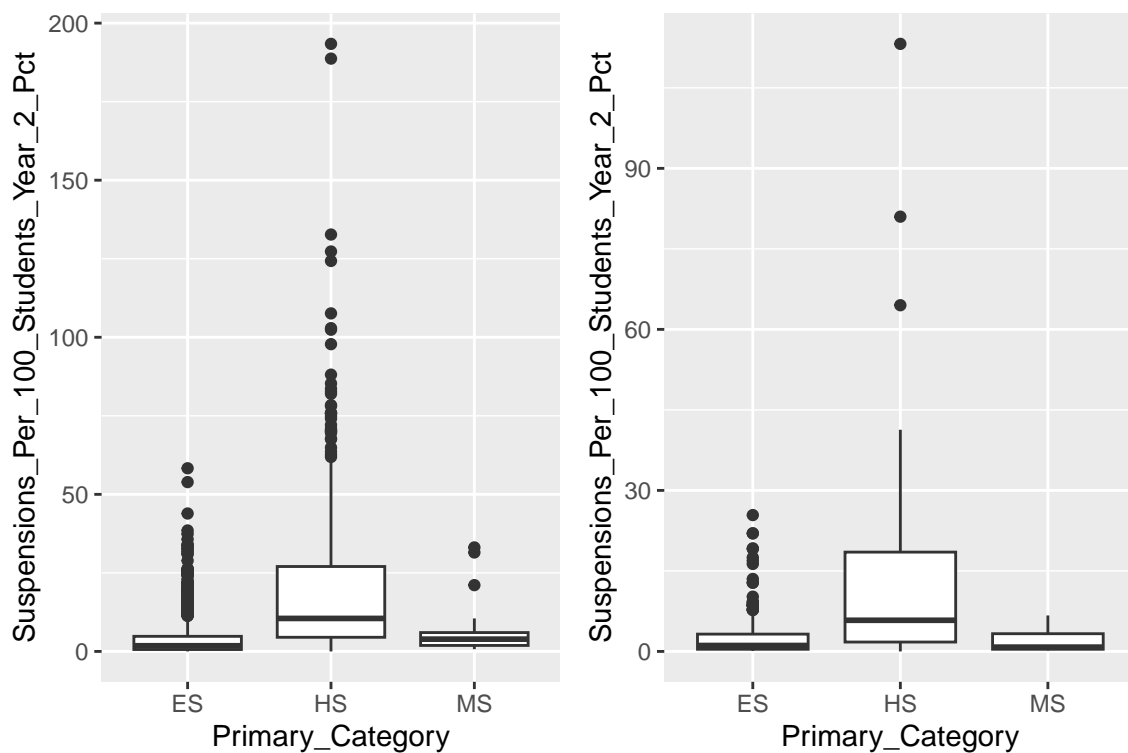


Figure 12: Box Plots of Suspensions with pre covid on the left and post covid on the right

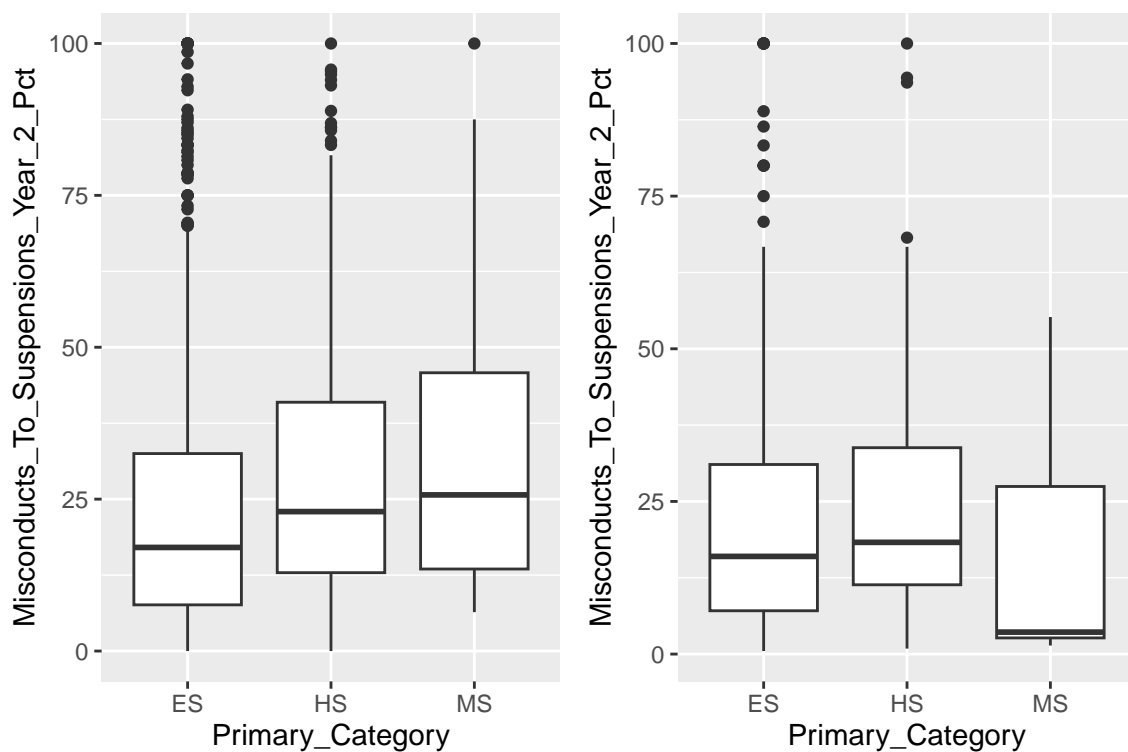


Figure 13: Box Plots of misconducts to suspensions with pre covid on the left and post covid on the right