```
> dat<-read.csv("Data_AirQuality_RO.csv")
> dat$COVID<-relevel(dat$COVID,ref="no")
> CO1<-subset(dat,PARAMETER=="CO")
> CO1$study.DD<-rep(1:dim(CO1)[1])
> CO<-subset(CO1,VALUE>-99)
> modelCO<-gamm(sqrt(sqrt(VALUE))~s(MM,k=6)+COVID,random=list(STATION.CODE=~1),data=na.omit(CO))
> summary(modelCO$gam)
```



```
Family: gaussian
Link function: identity


Formula:
sqrt(sqrt(VALUE)) ~ s(MM, k = 6) + COVID


Parametric coefficients:
                        Estimate Std. Error t value Pr(>|t|)
(Intercept)             0.630078   0.046632  13.512   <2e-16 ***
COVIDEmergency State   -0.009363   0.004415  -2.121    0.034 *
COVIDState of alert     0.005104   0.003599   1.418    0.156
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


Approximate significance of smooth terms:
        edf Ref.df     F p-value
s(MM) 4.609  4.609 165.8  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


R-sq.(adj) =  0.0526
  Scale est. = 0.0070612  n = 3779
> EMERGENCY.STATE.CO<-round(((4^(summary(modelCO$gam)$p.coeff[1]+summary(modelCO$gam)$p.coeff[2])- 4^(summary(mod
m)$p.coeff[1]))*100)
> EMERGENCY.STATE.CO
(Intercept)
         -1
> STATE.OF.ALERT.CO<-round(((4^(summary(modelCO$gam)$p.coeff[1]+summary(modelCO$gam)$p.coeff[3])- 4^(summary(mode
m)$p.coeff[1]))*100)
> STATE.OF.ALERT.CO
(Intercept)
          1
```
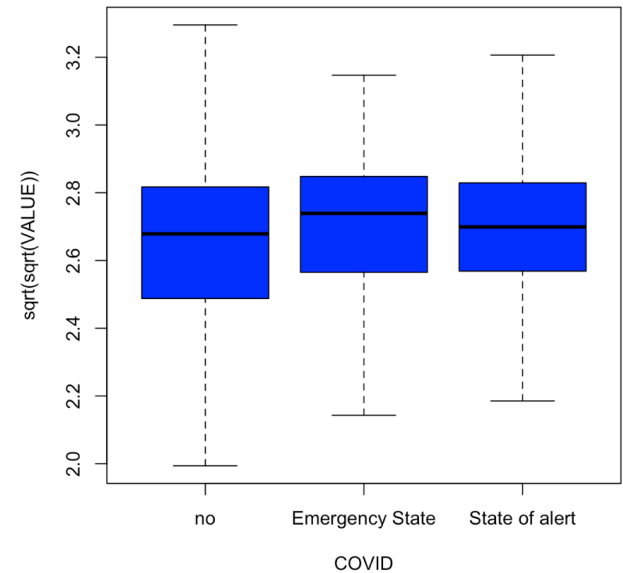
```
> model03<-gamm(sqrt(sqrt(VALUE))~s(MM,k=6)+COVID,random=list(STATION.CODE=~1),data=na.omit(O3))
> summary(model03$gam)


Family: gaussian
Link function: identity


Formula:
sqrt(sqrt(VALUE)) ~ s(MM, k = 6) + COVID


Parametric coefficients:
                   Estimate Std. Error t value Pr(>|t|)
(Intercept)        2.635702   0.040240  65.500  < 2e-16 ***
COVIDEmergency State 0.029051 0.010490   2.770  0.00564 **
COVIDState of alert 0.056112  0.008483   6.614 4.17e-11 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


Approximate significance of smooth terms:
        edf Ref.df     F p-value
s(MM) 4.785  4.785 32.84  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


R-sq.(adj) =  0.0361
  Scale est. = 0.042531  n = 4433
>
> EMERGENCY.STATE.O3<-round((((4^(summary(model03$gam)$p.coeff[1]+summary(model03$gam)$p.coeff[2])
m)$p.coeff[1]))*100)
> EMERGENCY.STATE.O3
(Intercept)
          4

>
> STATE.OF.ALERT.O3<-round((((4^(summary(model03$gam)$p.coeff[1]+summary(model03$gam)$p.coeff[3])-
m)$p.coeff[1]))*100)
> STATE.OF.ALERT.O3
(Intercept)
          8
```
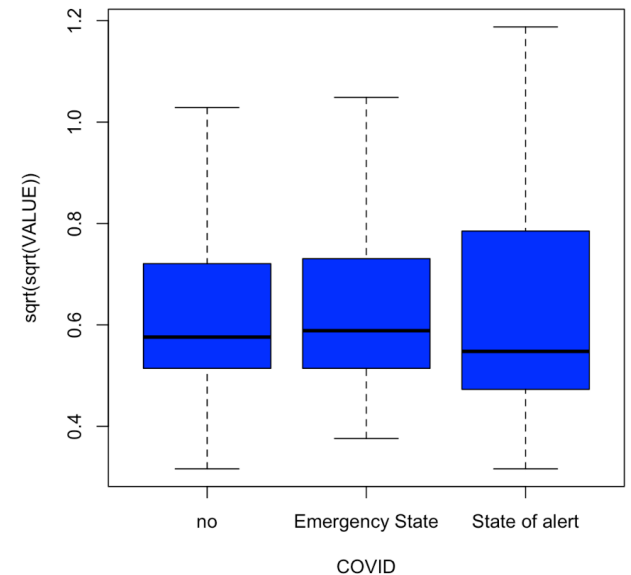
```r
> modelNOx<-gamm(sqrt(sqrt(VALUE))~s(MM,k=6)+COVID,random=list(STATION.CODE=~1),data=na.omit(NOx))
> summary(modelNOx$gam)
```

Family: gaussian
Link function: identity

Formula:
sqrt(sqrt(VALUE)) ~ s(MM, k = 6) + COVID

Parametric coefficients:
```
                       Estimate Std. Error t value Pr(>|t|)
(Intercept)             2.39366    0.03365  71.135  < 2e-16 ***
COVIDEmergency State   -0.17600    0.01386 -12.694  < 2e-16 ***
COVIDState of alert    -0.06830    0.01147  -5.955 2.84e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Approximate significance of smooth terms:
```
        edf Ref.df     F p-value
s(MM) 4.41   4.41 94.76  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```


R-sq.(adj) = 0.126
  Scale est. = 0.061424 n = 3760
```r
>
> EMERGENCY.STATE.NOx<-round((((4^(summary(modelNOx$gam)$p.coeff[1]+summary(modelNOx$gam)$p.coeff[2])
Ox$gam)$p.coeff[1]))*100)
> EMERGENCY.STATE.NOx
(Intercept)
        -22
>
> STATE.OF.ALERT.NOx<-round((((4^(summary(modelNOx$gam)$p.coeff[1]+summary(modelNOx$gam)$p.coeff[3])-
Ox$gam)$p.coeff[1]))*100)
> STATE.OF.ALERT.NOx
(Intercept)
         -9
```
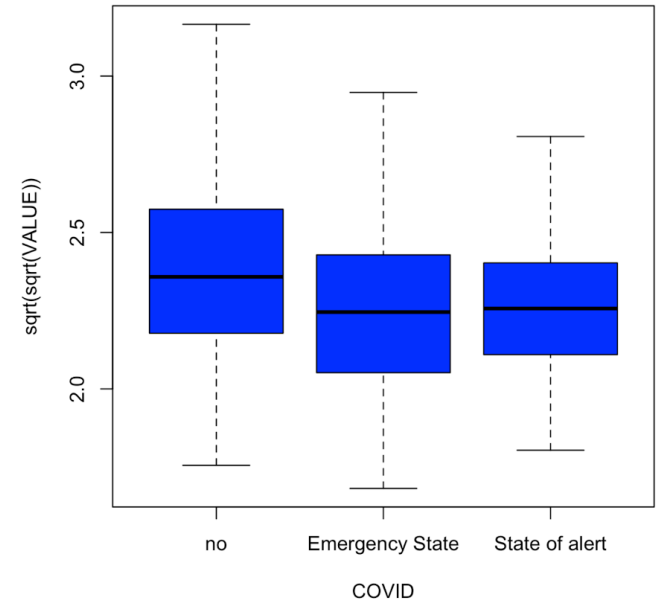
```
> modelPM_10<-gamm(sqrt(sqrt(VALUE))~s(MM,k=6)+COVID,random=list(STATION.CODE=~1),data=na.omit(PM_10))
> summary(modelPM_10$gam)


Family: gaussian
Link function: identity

Formula:
sqrt(sqrt(VALUE)) ~ s(MM, k = 6) + COVID

Parametric coefficients:
                      Estimate Std. Error t value Pr(>|t|)
(Intercept)            2.18391    0.03919  55.722  < 2e-16 ***
COVIDEmergency State  -0.06342    0.01224  -5.181 2.33e-07 ***
COVIDState of alert   -0.17783    0.01193 -14.908  < 2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
        edf Ref.df     F p-value
s(MM) 4.919  4.919 55.46  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.131
  Scale est. = 0.051962  n = 3740
>
> EMERGENCY.STATE.PM_10<-round(((4^(summary(modelPM_10$gam)$p.coeff[1]+summary(modelPM_10$gam)$p.coeff[
y(modelPM_10$gam)$p.coeff[1]))*100)
> EMERGENCY.STATE.PM_10
(Intercept)
         -8
>
> STATE.OF.ALERT.PM_10<-round(((4^(summary(modelPM_10$gam)$p.coeff[1]+summary(modelPM_10$gam)$p.coeff[3
y(modelPM_10$gam)$p.coeff[1]))*100)
> STATE.OF.ALERT.PM_10
(Intercept)
        -22
```
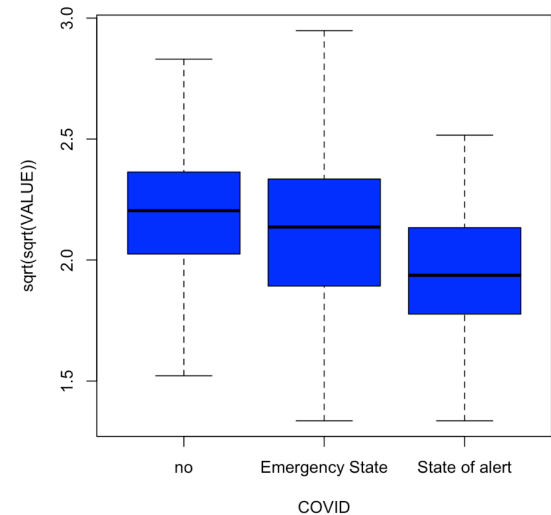
```
> modelPM_2.5<-gamm(sqrt(sqrt(VALUE))~s(MM,k=6)+COVID,random=list(STATION.CODE=~1),data=na.omit(PM_2.5))
> summary(modelPM_2.5$gam)


Family: gaussian
Link function: identity

Formula:
sqrt(sqrt(VALUE)) ~ s(MM, k = 6) + COVID


Parametric coefficients:
                       Estimate Std. Error t value Pr(>|t|)
(Intercept)             1.96421    0.03431   57.24   <2e-16 ***
COVIDEmergency State   -0.16185    0.01468  -11.03   <2e-16 ***
COVIDState of alert    -0.19007    0.01375  -13.82   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


Approximate significance of smooth terms:
        edf Ref.df     F p-value
s(MM) 4.892  4.892 73.42  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


R-sq.(adj) =  0.195
  Scale est. = 0.043519  n = 3017
>
> EMERGENCY.STATE.PM_2.5<-round(((4^(summary(modelPM_2.5$gam)$p.coeff[1]+summary(modelPM_2.5$gam)$p.coeff
mmary(modelPM_2.5$gam)$p.coeff[1]))*100)
> EMERGENCY.STATE.PM_2.5
(Intercept)
        -20
>
> STATE.OF.ALERT.PM_2.5<-round(((4^(summary(modelPM_2.5$gam)$p.coeff[1]+summary(modelPM_2.5$gam)$p.coeff[
mmary(modelPM_2.5$gam)$p.coeff[1]))*100)
> STATE.OF.ALERT.PM_2.5
(Intercept)
        -23
```