

# Practica2\_Inferencia

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## Cargar datos

```
#install.packages("readr")
#install.packages("dplyr")
#install.packages("ggplot2")
#install.packages("GGally")
library(dplyr)

##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
## filter, lag

## The following objects are masked from 'package:base':
##
## intersect, setdiff, setequal, union

ruta_Excel_CalidadAire <- "CalidadAire14_19_zonaProv.csv"
data_CalidadAire <- read.csv(ruta_Excel_CalidadAire, header=TRUE, sep=';',
                             dec = ',')
CalidadAire <- select(data_CalidadAire, Year, CodProv, Population,
                      PM10.population.weighted.average..ug.m3.,
                      PM2.5.population.weighted.average..ug.m3.,
                      NO2.population.weighted.average..ug.m3.,
                      O3.SOM035.population.weighted.average..ug.days.m3.)

names(CalidadAire) = c("Year", "CodProv", "Population", "Factor_PM10",
                      "Factor_PM2.5", "Factor_NO2", "Factor_O3")

CalidadAire_Final <- CalidadAire %>%
  group_by(CodProv, Year) %>%
  summarise_all(sum)

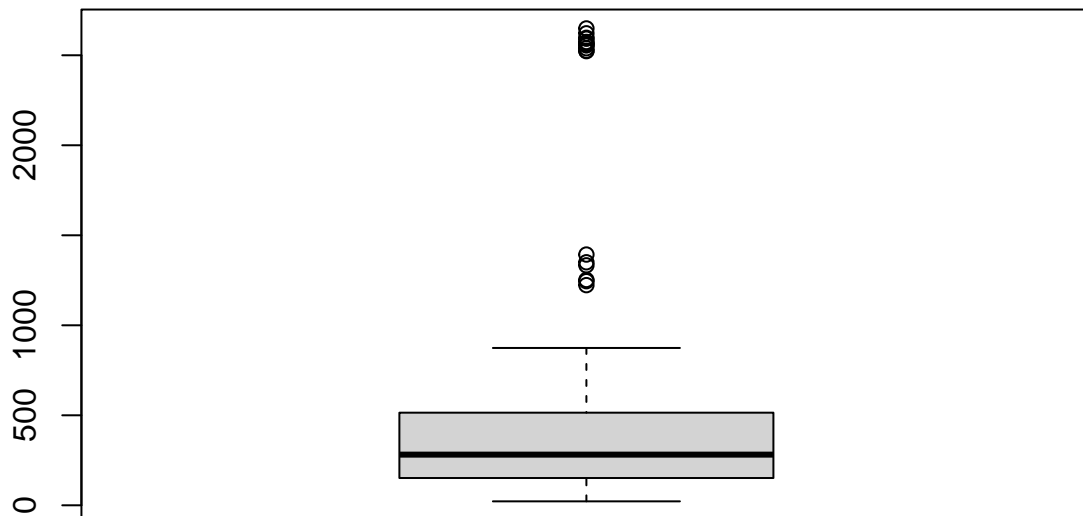
ruta_Excel_datosCP <- "Datos_CP_14_19_prov.csv"
data_datosCP <- read.csv(ruta_Excel_datosCP, header=TRUE, sep=";")
names(data_datosCP) = c("Year", "CodProv", "CIE10", "Provincia",
                      "SumaTotal", "value_f", "value_m")
```

```
data_final <- merge(data_datosCP, CalidadAire_Final, by = c("Year", "CodProv"))
data_final$Prevalencia = round( (data_final$SumaTotal * 100000) / data_final$Population , 2 )
head(data_final)
```

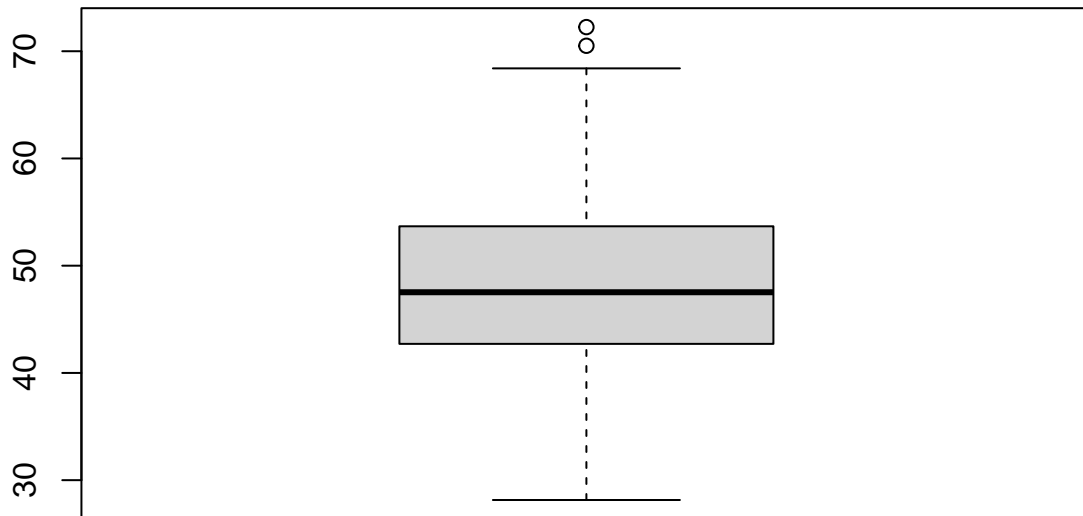
##	Year	CodProv	CIE10	Provincia	SumaTotal	value_f	value_m
## 1	2014	1	C33-C34	Araba/Á\2011lava	146	25	121
## 2	2014	10	C33-C34	CÁ\303\201\303ceres	226	30	196
## 3	2014	11	C33-C34	CÁ\303\201\303diz	507	70	437
## 4	2014	12	C33-C34	CastellÁ\303\201\303n/CastellÁ\303\201\303	238	30	208
## 5	2014	13	C33-C34	Ciudad Real	263	38	225
## 6	2014	14	C33-C34	CÁ\303\201\303rdoba	297	34	263
##	Population	Factor_PM10	Factor_PM2.5	Factor_NO2	Factor_O3	Prevalencia	
## 1	323249	17.0	10.5	17.9	3744.9	45.17	
## 2	415041	13.7	6.9	9.0	4113.5	54.45	
## 3	1171305	26.3	13.4	16.6	4979.7	43.29	
## 4	582572	16.7	9.2	12.9	5876.8	40.85	
## 5	531721	18.5	9.7	15.2	6640.5	49.46	
## 6	810185	21.4	11.8	16.0	6258.7	36.66	

## BoxPlot

You can also embed plots, for example:



```
boxplot(data_final$Prevalencia)
```



```
## Correlación
```

```
Data_Correlacion_SumaTotal <- select(data_final, Factor_PM10, Factor_PM2.5, Factor_NO2, Factor_O3, Prevalencia)
round(cor(Data_Correlacion_SumaTotal),4)
```

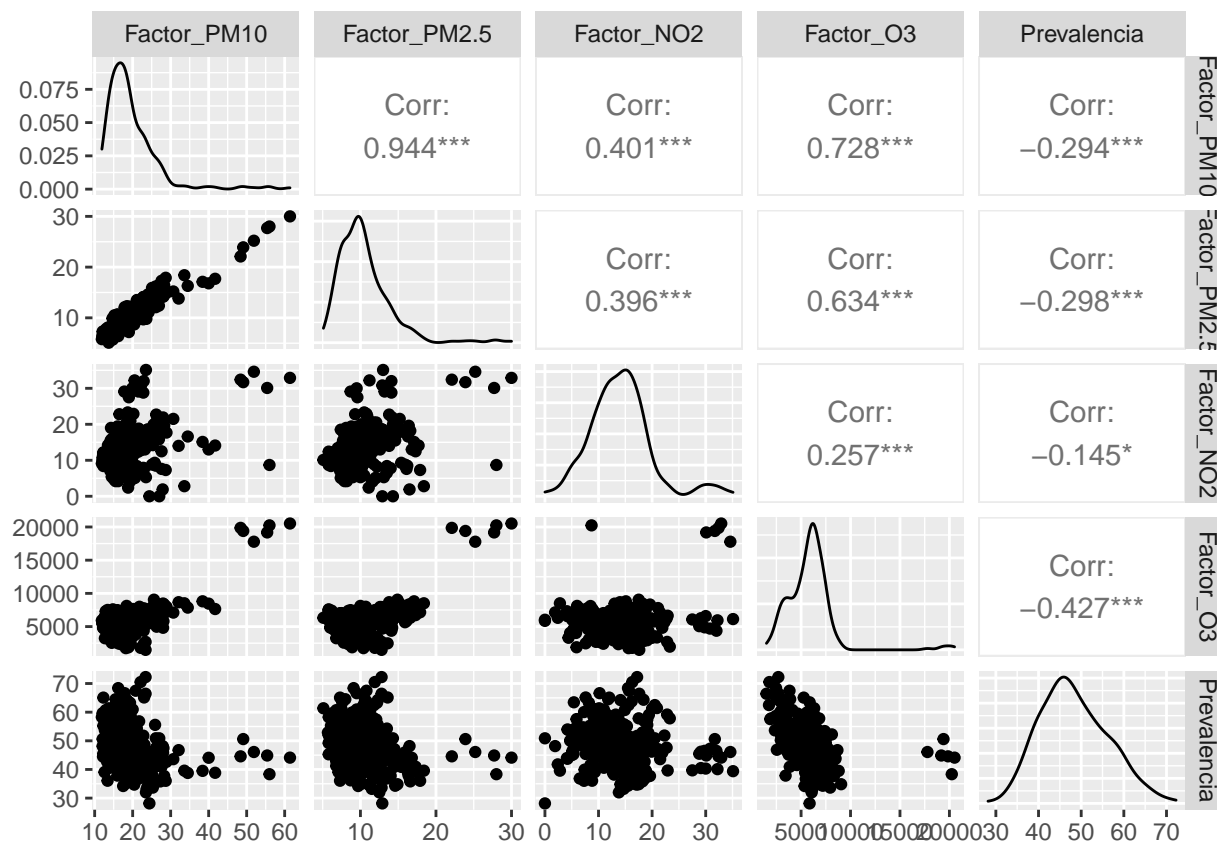
```
##           Factor_PM10 Factor_PM2.5 Factor_NO2 Factor_O3 Prevalencia
## Factor_PM10      1.0000      0.9443      0.4010      0.7284      -0.2943
## Factor_PM2.5      0.9443      1.0000      0.3959      0.6341      -0.2979
## Factor_NO2        0.4010      0.3959      1.0000      0.2572      -0.1448
## Factor_O3         0.7284      0.6341      0.2572      1.0000      -0.4273
## Prevalencia       -0.2943     -0.2979     -0.1448     -0.4273      1.0000
```

```
library(ggplot2)
library(GGally)
```

```
## Registered S3 method overwritten by 'GGally':
##   method from
##   +.gg      ggplot2
```

```
ggpairs(Data_Correlacion_SumaTotal, lower = list(continuous="smooth"), diag = list(continuous="barDiag"),
```

```
## Warning in warn_if_args_exist(list(...)): Extra arguments: "axislabels" are
## being ignored. If these are meant to be aesthetics, submit them using the
## 'mapping' variable within ggpairs with ggplot2::aes or ggplot2::aes_string.
```



## Selección variables menor pValues para la regresión

```
modelo <- lm(Prevalencia~Factor_PM10 + Factor_PM2.5 + Factor_NO2 + Factor_O3, data = Data_Correlacion_SumaTotal)
summary(modelo)
```

```
##
## Call:
## lm(formula = Prevalencia ~ Factor_PM10 + Factor_PM2.5 + Factor_NO2 +
##     Factor_O3, data = Data_Correlacion_SumaTotal)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -21.4463  -5.2897  -0.8009   4.5632  21.2394
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  57.6134943   1.4430049   39.926 < 2e-16 ***
## Factor_PM10   0.5716805   0.2120611    2.696  0.00742 **
## Factor_PM2.5 -0.9740537   0.3695113   -2.636  0.00883 **
## Factor_NO2   -0.0602769   0.0774903   -0.778  0.43727
## Factor_O3    -0.0016041   0.0002477   -6.475 3.96e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Residual standard error: 7.129 on 295 degrees of freedom
## Multiple R-squared:  0.2041, Adjusted R-squared:  0.1933
## F-statistic: 18.91 on 4 and 295 DF,  p-value: 7.413e-14
```

## Regresión lineal múltiple

Se seleccionan las variables factor03, factorPM2.5, FactorPm10

```
library(caTools)
library(caret)
```

```
## Loading required package: lattice
```

```
set.seed(123)
split = sample.split(Data_Correlacion_SumaTotal$Prevalencia, SplitRatio = 0.8)
training_set = subset(Data_Correlacion_SumaTotal, split == TRUE)
testing_set = subset(Data_Correlacion_SumaTotal, split == FALSE)

regression = lm(Prevalencia~Factor_PM10 + Factor_PM2.5 + Factor_03, data = training_set)

y_pred = predict(regression, newdata = testing_set)

RMSE(y_pred, testing_set$Prevalencia)
```

```
## [1] 6.839546
```

```
R2(y_pred, testing_set$Prevalencia)
```

```
## [1] 0.18926
```

```
y_pred
```

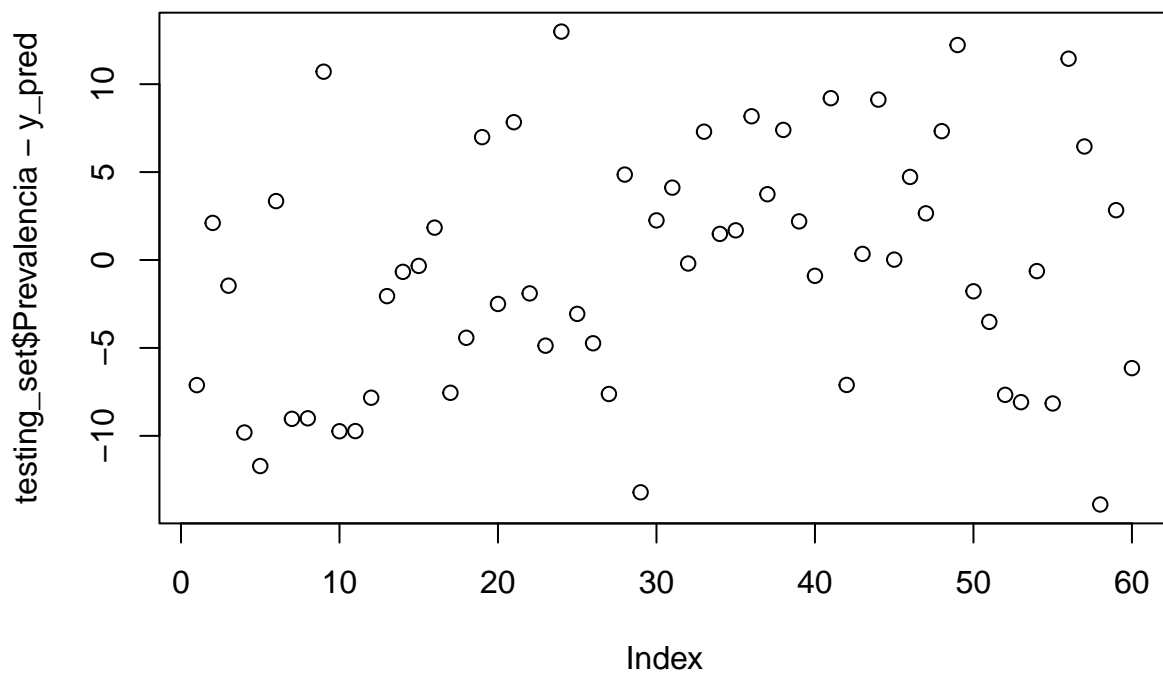
```
##      4      5      8     11     16     20     21     24
## 47.96502 47.35136 47.16020 48.11990 46.42775 52.10031 48.72348 47.67302
##      31      32      34      50      53      59      65      67
## 50.03943 48.51907 48.63853 49.51171 47.45319 45.68329 47.68539 49.59891
##      68      69      87      88      89     104     106     107
## 47.04195 49.12227 46.97153 46.40889 46.44290 47.28960 45.66223 53.63975
##     111     114     118     126     132     137     139     145
## 45.34335 47.91541 49.16012 51.29127 52.05276 46.81609 48.49458 51.08925
##     151     173     179     181     189     190     193     195
## 51.77219 45.99525 56.16272 54.30543 48.10815 47.89123 47.27343 48.51892
##     202     206     219     220     222     230     238     240
## 49.40668 47.58466 49.37406 50.77834 48.04740 47.80661 46.68681 47.80244
##     248     249     260     261     262     264     271     277
## 33.86352 48.27946 46.18887 46.40885 48.45555 50.56096 48.63812 52.35125
##     294     296     297     300
## 50.49440 50.62383 50.07646 49.03823
```

```
testing_set$Prevalencia
```

```
## [1] 40.85 49.46 45.70 38.31 34.71 55.45 39.69 38.67 60.75 38.78 38.91 41.68  
## [13] 45.40 45.01 47.35 51.44 39.49 44.70 53.96 43.91 54.28 45.39 40.79 66.63  
## [25] 42.28 43.18 41.54 56.15 38.84 49.07 52.61 50.89 59.07 47.48 57.85 62.48  
## [37] 51.85 55.29 49.47 47.62 58.61 40.48 49.72 59.90 48.07 52.53 49.34 55.13  
## [49] 46.09 46.50 42.67 38.74 40.37 49.93 40.48 63.80 56.95 36.72 52.91 42.89
```

```
y_compared = data.frame(y_pred,testing_set$Prevalencia )
```

```
plot( testing_set$Prevalencia - y_pred)
```



```
## Refresión SVR
```

```
library(e1071)  
regression = svm(formula = Prevalencia~Factor_PM10 + Factor_PM2.5 + Factor_O3,  
                  data = training_set,  
                  type = "eps-regression",  
                  kernel = "radial")  
y_pred = predict(regression, newdata =testing_set )  
RMSE(y_pred, testing_set$Prevalencia)
```

```
## [1] 5.474367
```

```
R2(y_pred, testing_set$Prevalencia)
```

```
## [1] 0.5070083
```

```
y_pred
```

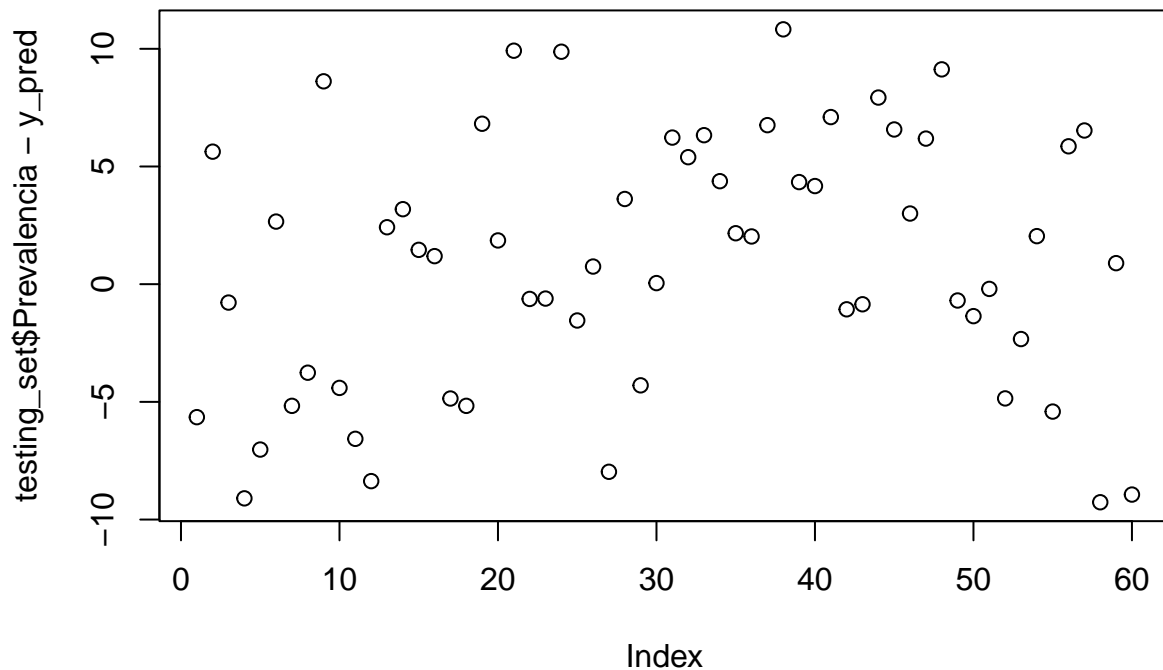
```
##      4      5      8     11     16     20     21     24
## 46.49961 43.82946 46.48122 47.41000 41.73681 52.78973 44.85953 42.43125
##      31     32     34     50     53     59     65     67
## 52.13097 43.18692 45.48120 50.04827 42.98048 41.82346 45.89178 50.24911
##      68     69     87     88     89    104    106    107
## 44.34831 49.86929 47.14289 42.05096 44.36055 46.01726 41.40091 56.75346
##     111     114     118     126     132     137     139     145
## 43.82296 42.43035 49.51143 52.53057 43.13840 49.02398 46.38078 45.49459
##     151     173     179     181     189     190     193     195
## 52.73979 43.10351 55.68531 60.45243 45.09327 44.46284 45.13177 43.45093
##     202     206     219     220     222     230     238     240
## 51.51010 41.54740 50.57426 51.97107 41.49676 49.52806 43.15434 46.00300
##     248     249     260     261     262     264     271     277
## 46.78299 47.85749 42.87062 43.59363 42.70161 47.88859 45.89347 57.94199
##     294     296     297     300
## 50.42030 45.98476 52.01665 51.82837
```

```
testing_set$Prevalencia
```

```
## [1] 40.85 49.46 45.70 38.31 34.71 55.45 39.69 38.67 60.75 38.78 38.91 41.68
## [13] 45.40 45.01 47.35 51.44 39.49 44.70 53.96 43.91 54.28 45.39 40.79 66.63
## [25] 42.28 43.18 41.54 56.15 38.84 49.07 52.61 50.89 59.07 47.48 57.85 62.48
## [37] 51.85 55.29 49.47 47.62 58.61 40.48 49.72 59.90 48.07 52.53 49.34 55.13
## [49] 46.09 46.50 42.67 38.74 40.37 49.93 40.48 63.80 56.95 36.72 52.91 42.89
```

```
y_compared = data.frame(y_pred,testing_set$Prevalencia )
```

```
plot( testing_set$Prevalencia - y_pred)
```



## Regresión RF

```
library(randomForest)

## randomForest 4.7-1

## Type rfNews() to see new features/changes/bug fixes.

##
## Attaching package: 'randomForest'

## The following object is masked from 'package:ggplot2':
##
##   margin

## The following object is masked from 'package:dplyr':
##
##   combine

set.seed(1234)
regression = randomForest(x = training_set[, 1:4],
                          y = training_set$Prevalencia,
```



```

                                ntree = 100)
y_pred = predict(regression, newdata =testing_set )
RMSE(y_pred, testing_set$Prevalencia)

```

```
## [1] 5.72547
```

```
R2(y_pred, testing_set$Prevalencia)
```

```
## [1] 0.4430676
```

```
y_pred
```

```

##          4          5          8          11          16          20          21          24
## 47.83692 42.87965 46.85679 47.12104 42.19231 55.11470 45.90915 45.61557
##          31          32          34          50          53          59          65          67
## 45.65535 41.55078 43.53490 49.02617 43.30266 47.08764 51.74716 50.45528
##          68          69          87          88          89         104         106         107
## 51.56108 49.45451 46.83133 47.58241 47.62439 48.56820 40.60756 57.29395
##          111         114         118         126         132         137         139         145
## 43.81743 47.41464 47.43941 52.81947 40.53229 47.09726 45.20984 48.11468
##          151         173         179         181         189         190         193         195
## 50.74210 44.10323 55.25721 57.71128 47.00006 48.55874 46.30458 44.45282
##          202         206         219         220         222         230         238         240
## 49.77555 43.39928 46.33174 52.61790 44.77107 48.69246 44.31264 45.59141
##          248         249         260         261         262         264         271         277
## 45.53448 46.63955 41.63241 44.91799 42.58298 49.73060 47.09435 58.38111
##          294         296         297         300
## 51.31381 42.00340 50.91037 54.28621

```

```
testing_set$Prevalencia
```

```

## [1] 40.85 49.46 45.70 38.31 34.71 55.45 39.69 38.67 60.75 38.78 38.91 41.68
## [13] 45.40 45.01 47.35 51.44 39.49 44.70 53.96 43.91 54.28 45.39 40.79 66.63
## [25] 42.28 43.18 41.54 56.15 38.84 49.07 52.61 50.89 59.07 47.48 57.85 62.48
## [37] 51.85 55.29 49.47 47.62 58.61 40.48 49.72 59.90 48.07 52.53 49.34 55.13
## [49] 46.09 46.50 42.67 38.74 40.37 49.93 40.48 63.80 56.95 36.72 52.91 42.89

```

```
y_compared = data.frame(y_pred,testing_set$Prevalencia )
```

```
plot( testing_set$Prevalencia - y_pred)
```

