Factor_Analysis.R

Kaustubh Chalke

2019-10-25

```
# Factor Analysis
HCV<- read.csv("HCV-Egy-Data.csv")

View(HCV)
attach(HCV)
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

Survivorship = HCV$Survivorship <- if_else( RNA.EOT>= 400000 , 'NC','C')
cbind(data.frame(Survivorship),HCV)

##      Survivorship Age Gender BMI Fever Nausea.Vomting Headache Diarrhea
## 1               C  56      1  35     2              1        1        1
## 2               C  46      1  29     1              2        2        1
## 3              NC  57      1  33     2              2        2        2
## 4              NC  49      2  33     1              2        1        2
## 5               C  59      1  32     1              1        2        1
## 6               C  58      2  22     2              2        2        1
## 7               C  42      2  26     1              1        2        2
## 8               C  48      2  30     1              1        2        2
## 9               C  44      1  23     1              1        2        2
## 10              C  45      1  30     2              1        2        2
## 11             NC  37      2  24     2              1        2        1
## 12              C  36      1  22     2              2        1        1
## 13              C  45      2  25     2              1        1        1
## 14              C  34      1  22     1              2        1        1
## 15             NC  40      2  32     2              2        2        1
## 16             NC  58      1  34     2              1        1        1
## 17              C  61      1  35     1              2        2        2
## 18              C  55      2  24     2              1        2        2
## 19             NC  56      1  27     1              2        2        2
## 20             NC  35      2  23     2              2        1        1
## 21             NC  57      2  23     1              1        2        2
```

```r
hcv_pca <- prcomp(HCV_pca, scale=TRUE)
summary(hcv_pca)

## Importance of components:
##                            PC1     PC2    PC3     PC4     PC5     PC6
## Standard deviation     1.08404 1.05059 1.0387 1.02934 1.01426 1.01148
## Proportion of Variance 0.09793 0.09198 0.0899 0.08829 0.08573 0.08526
## Cumulative Proportion  0.09793 0.18991 0.2798 0.36810 0.45383 0.53909
##                           PC7     PC8     PC9    PC10   PC11    PC12
## Standard deviation     0.9962 0.98907 0.97517 0.95981 0.9327 0.90452
## Proportion of Variance 0.0827 0.08152 0.07925 0.07677 0.0725 0.06818
## Cumulative Proportion  0.6218 0.70331 0.78255 0.85932 0.9318 1.00000

plot(hcv_pca)
# A table containing eigenvalues and %'s accounted, follows. Eigenvalues are
the sdev^2
(eigen_hcv <- round(hcv_pca$sdev^2,2))

##  [1] 1.18 1.10 1.08 1.06 1.03 1.02 0.99 0.98 0.95 0.92 0.87 0.82

names(eigen_hcv) <- paste("PC",1:12,sep="")
eigen_hcv

##  PC1  PC2  PC3  PC4  PC5  PC6  PC7  PC8  PC9 PC10 PC11 PC12
## 1.18 1.10 1.08 1.06 1.03 1.02 0.99 0.98 0.95 0.92 0.87 0.82

sumlambdas <- sum(eigen_hcv)
sumlambdas

## [1] 12

propvar <- round(eigen_hcv/sumlambdas,2)
propvar

##  PC1  PC2  PC3  PC4  PC5  PC6  PC7  PC8  PC9 PC10 PC11 PC12
## 0.10 0.09 0.09 0.09 0.09 0.08 0.08 0.08 0.08 0.08 0.07 0.07

cumvar_hcv <- cumsum(propvar)
cumvar_hcv

##  PC1  PC2  PC3  PC4  PC5  PC6  PC7  PC8  PC9 PC10 PC11 PC12
## 0.10 0.19 0.28 0.37 0.46 0.54 0.62 0.70 0.78 0.86 0.93 1.00

matlambdas <- rbind(eigen_hcv,propvar,cumvar_hcv)
matlambdas

##             PC1  PC2  PC3  PC4  PC5  PC6  PC7  PC8  PC9 PC10 PC11 PC12
## eigen_hcv  1.18 1.10 1.08 1.06 1.03 1.02 0.99 0.98 0.95 0.92 0.87 0.82
## propvar    0.10 0.09 0.09 0.09 0.09 0.08 0.08 0.08 0.08 0.08 0.07 0.07
## cumvar_hcv 0.10 0.19 0.28 0.37 0.46 0.54 0.62 0.70 0.78 0.86 0.93 1.00
```

```r
rownames(matlambdas) <- c("Eigenvalues","Prop. variance","Cum. prop.
variance")
rownames(matlambdas)

## [1] "Eigenvalues"         "Prop. variance"      "Cum. prop. variance"

eigvec.hcv <- hcv_pca$rotation
print(hcv_pca)

## Standard deviations (1, .., p=12):
##  [1] 1.0840427 1.0505938 1.0386641 1.0293370 1.0142649 1.0114786 0.9961803
##  [8] 0.9890660 0.9751702 0.9598120 0.9327088 0.9045197
##
## Rotation (n x k) = (12 x 12):
##                          PC1          PC2         PC3          PC4
## Age              -0.09529935  0.284882543  0.31747295  0.338906000
## Gender           -0.01044315 -0.316250295 -0.07203548  0.198455085
## Nausea.Vomting    0.52480080  0.088540649 -0.24781518  0.107734234
## Jaundice         -0.10889929  0.057223969 -0.15761428  0.550381317
## Epigastric.pain -0.36243330  0.087014225 -0.40100204 -0.424062232
## WBC              -0.31925445 -0.018338105  0.01645813  0.205418062
## Plat              0.55719490 -0.204281272 -0.04274376  0.006393138
## AST.1             0.02697707  0.443073086 -0.19135091 -0.310995830
## ALT.1             0.32045717  0.407795297 -0.33720628  0.061155423
## ALT.after.24.w   -0.18820970  0.008476448 -0.38978528 -0.004039055
## RNA.Base         -0.13955452  0.282607286 -0.34255100  0.449136202
## RNA.EOT          -0.03831018 -0.561716624 -0.47462581  0.083473231
##                           PC5         PC6         PC7         PC8
## Age              -0.002212279 -0.37355037 -0.04875916 -0.44436803
## Gender           -0.677696273 -0.22936402 -0.29458461  0.28262743
## Nausea.Vomting    0.236489116 -0.03939247  0.38658341  0.10081836
## Jaundice         -0.091079291  0.59055330  0.08817802  0.01018116
## Epigastric.pain -0.107455186 -0.04176427  0.06035269 -0.49894025
## WBC              -0.350199687 -0.12886045  0.73719558 -0.05030833
## Plat             -0.184948482 -0.16921682  0.24574326 -0.29402786
## AST.1            -0.299205035  0.29242475  0.12604131  0.24969134
## ALT.1            -0.327303100 -0.10706918 -0.28177087 -0.18531477
## ALT.after.24.w    0.206078032 -0.52920937  0.11414766  0.44898794
## RNA.Base          0.234651816 -0.12214543 -0.17512225 -0.01675482
## RNA.EOT           0.118014180  0.13640232 -0.08457018 -0.27551387
##                           PC9        PC10        PC11        PC12
## Age               0.520792542  0.13577096 -0.23596778  0.09689700
## Gender           -0.006169086  0.07272571 -0.35241526 -0.21735019
## Nausea.Vomting   -0.014602955 -0.13365869 -0.63442826 -0.07783699
## Jaundice          0.320862480 -0.27375624  0.14539380 -0.30519221
## Epigastric.pain -0.014426575 -0.14347333 -0.19835482 -0.44093897
## WBC              -0.281821277 -0.02758649  0.05666123  0.29435529
## Plat              0.091339000  0.28486892  0.47530120 -0.34763250
## AST.1             0.326466725  0.53259952 -0.04585550  0.15495592
## ALT.1            -0.134042709 -0.42464147  0.19333300  0.38153525
```

```
## ALT.after.24.w   0.401358681 -0.17496164  0.28277459 -0.06118809
## RNA.Base        -0.456743248  0.49191702  0.04710736 -0.16687657
## RNA.EOT          0.208196459  0.21070746 -0.07972966  0.49099507

# Taking the first four PCs to generate linear combinations for all the
variables with four factors
pcafactors.hcv <- eigvec.hcv[,1:4]
pcafactors.hcv

##                         PC1          PC2         PC3          PC4
## Age            -0.09529935  0.284882543  0.31747295  0.338906000
## Gender         -0.01044315 -0.316250295 -0.07203548  0.198455085
## Nausea.Vomting  0.52480080  0.088540649 -0.24781518  0.107734234
## Jaundice       -0.10889929  0.057223969 -0.15761428  0.550381317
## Epigastric.pain -0.36243330  0.087014225 -0.40100204 -0.424062232
## WBC            -0.31925445 -0.018338105  0.01645813  0.205418062
## Plat            0.55719490 -0.204281272 -0.04274376  0.006393138
## AST.1           0.02697707  0.443073086 -0.19135091 -0.310995830
## ALT.1           0.32045717  0.407795297 -0.33720628  0.061155423
## ALT.after.24.w -0.18820970  0.008476448 -0.38978528 -0.004039055
## RNA.Base       -0.13955452  0.282607286 -0.34255100  0.449136202
## RNA.EOT        -0.03831018 -0.561716624 -0.47462581  0.083473231

# Multiplying each column of the eigenvector's matrix by the square-root of
the corresponding eigenvalue in order to get the factor loadings
unrot.fact.hcv <- sweep(pcafactors.hcv,MARGIN=2,hcv_pca$sdev[1:4],`*`)
unrot.fact.hcv

##                         PC1          PC2         PC3          PC4
## Age            -0.10330856  0.299295831  0.32974776  0.348848478
## Gender         -0.01132082 -0.332250596 -0.07482067  0.204277158
## Nausea.Vomting  0.56890646  0.093020256 -0.25739673  0.110894831
## Jaundice       -0.11805147  0.060119147 -0.16370829  0.566527842
## Epigastric.pain -0.39289316  0.091416605 -0.41650642 -0.436502936
## WBC            -0.34608544 -0.019265900  0.01709447  0.211444407
## Plat            0.60402305 -0.214616636 -0.04439641  0.006580694
## AST.1           0.02924429  0.465489833 -0.19874933 -0.320119508
## ALT.1           0.34738924  0.428427207 -0.35024406  0.062949538
## ALT.after.24.w -0.20402735  0.008905303 -0.40485597 -0.004157549
## RNA.Base       -0.15128305  0.296905460 -0.35579542  0.462312501
## RNA.EOT        -0.04152987 -0.590135998 -0.49297679  0.085922083

# Computing communalities
communalities.hcv <- rowSums(unrot.fact.hcv^2)
communalities.hcv

##             Age          Gender  Nausea.Vomting        Jaundice
##       0.3306795       0.1578459       0.4108581       0.3653047
## Epigastric.pain             WBC            Plat           AST.1
##       0.5267344       0.1651473       0.4129185       0.3595138
```

```
##           ALT.1  ALT.after.24.w        RNA.Base         RNA.EOT
##       0.4308627       0.2056321       0.4513626       0.6003939
```

```
# Performing the varimax rotation. The default in the varimax function is
norm=TRUE thus, Kaiser normalization is carried out
rot.fact.hcv <- varimax(unrot.fact.hcv)
View(unrot.fact.hcv)
rot.fact.hcv
```

```
## $loadings
##
## Loadings:
##                 PC1    PC2    PC3    PC4
## Age             -0.190  0.142  0.439  0.287
## Gender                 -0.390
## Nausea.Vomting   0.630                0.112
## Jaundice               -0.190         0.568
## Epigastric.pain -0.228  0.247 -0.639
## WBC             -0.322 -0.103         0.226
## Plat             0.570 -0.203  0.115 -0.184
## AST.1            0.107  0.546 -0.223
## ALT.1            0.470  0.343         0.287
## ALT.after.24.w                -0.403  0.204
## RNA.Base                      -0.105  0.661
## RNA.EOT          0.117 -0.595 -0.480
##
##                  PC1   PC2   PC3   PC4
## SS loadings    1.162 1.096 1.085 1.074
## Proportion Var 0.097 0.091 0.090 0.090
## Cumulative Var 0.097 0.188 0.279 0.368
##
## $rotmat
##             [,1]         [,2]      [,3]       [,4]
## [1,]  0.93119621 -0.005476209 0.3020940 -0.2039187
## [2,]  0.04203690  0.906775699 0.1510461  0.3913768
## [3,] -0.36023297  0.049131561 0.8413855 -0.3998608
## [4,]  0.03658853 -0.418705066 0.4218941  0.8033385
```

```
# The print method of varimax omits loadings less than abs(0.1). In order to
display all the loadings, it is necessary to ask explicitly the contents of
the object $loadings
fact.load.hcv <- rot.fact.hcv$loadings[1:9,1:4]
fact.load.hcv
```

```
##                          PC1         PC2          PC3          PC4
## Age             -0.189641232  0.14209632  0.438620690  0.286594181
## Gender           0.009918388 -0.39042271 -0.030374813  0.066294905
## Nausea.Vomting   0.630454087  0.02215453  0.016129583  0.112404278
## Jaundice        -0.027700318 -0.19009027  0.074691098  0.568176281
## Epigastric.pain -0.227949410  0.24734830 -0.639483053 -0.068218412
## WBC             -0.321504881 -0.10326758 -0.003870194  0.226059074
```

```
## Plat             0.569675983 -0.20285354  0.115476608 -0.184128639
## AST.1            0.106683282  0.54620552 -0.223136385 -0.001473782
## ALT.1            0.469969986  0.34301968 -0.098475760  0.287455983
```

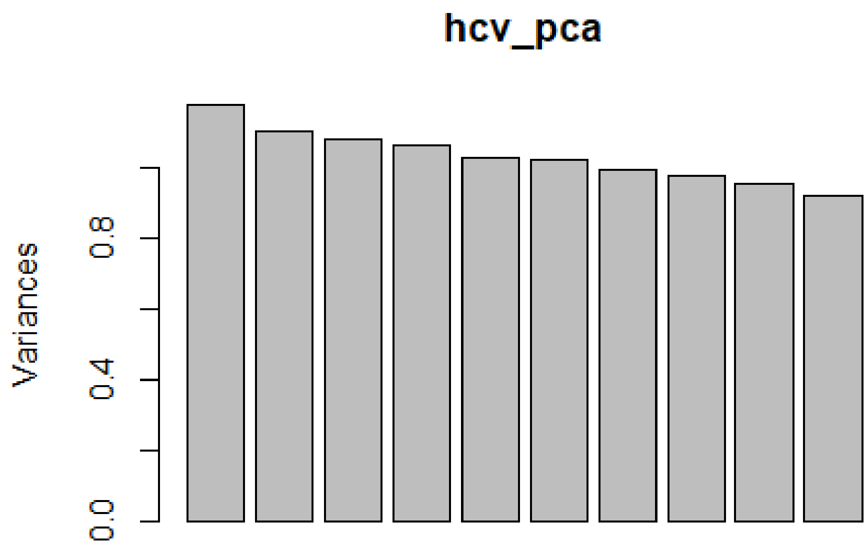
```
# Computing the rotated factor scores for the 30 European Countries. Notice that signs are reversed for factors F2 (PC2), F3 (PC3) and F4 (PC4)
scale.hcv <- scale(HCV[1:29])
scale.hcv
```

```
##                 Age     Gender         BMI      Fever Nausea.Vomting
##    [1,]  1.10241532 -0.9789225  1.56795830  0.9690704     -1.0047041
##    [2,] -0.03634155 -0.9789225  0.09600468 -1.0311717      0.9945993
##    [3,]  1.21629100 -0.9789225  1.07730709  0.9690704      0.9945993
##    [4,]  0.30528551  1.0207938  1.07730709 -1.0311717      0.9945993
##    [5,]  1.44404238 -0.9789225  0.83198149 -1.0311717     -1.0047041
##    [6,]  1.33016669  1.0207938 -1.62127455  0.9690704      0.9945993
##    [7,] -0.49184430  1.0207938 -0.63997214 -1.0311717     -1.0047041
##    [8,]  0.19140982  1.0207938  0.34133028 -1.0311717     -1.0047041
##    [9,] -0.26409293 -0.9789225 -1.37594895 -1.0311717     -1.0047041
##   [10,] -0.15021724 -0.9789225  0.34133028  0.9690704     -1.0047041
##   [11,] -1.06122274  1.0207938 -1.13062334  0.9690704     -1.0047041
##   [12,] -1.17509843 -0.9789225 -1.62127455  0.9690704      0.9945993
##   [13,] -0.15021724  1.0207938 -0.88529774  0.9690704     -1.0047041
##   [14,] -1.40284980 -0.9789225 -1.62127455 -1.0311717      0.9945993
##   [15,] -0.71959568  1.0207938  0.83198149  0.9690704      0.9945993
##   [16,]  1.33016669 -0.9789225  1.32263270  0.9690704     -1.0047041
##   [17,]  1.67179375 -0.9789225  1.56795830 -1.0311717      0.9945993
##   [18,]  0.98853963  1.0207938 -1.13062334  0.9690704     -1.0047041
##   [19,]  1.10241532 -0.9789225 -0.39464653 -1.0311717      0.9945993
##   [20,] -1.28897411  1.0207938 -1.37594895  0.9690704      0.9945993
##   [21,]  1.21629100  1.0207938 -1.37594895 -1.0311717     -1.0047041
##   [22,] -1.51672549 -0.9789225 -0.88529774  0.9690704     -1.0047041
##   [23,] -0.60571999 -0.9789225 -1.37594895 -1.0311717      0.9945993
##   [24,] -0.83347136  1.0207938  0.09600468 -1.0311717      0.9945993
##   [25,] -1.51672549  1.0207938 -1.13062334 -1.0311717      0.9945993
##   [26,] -0.37796862  1.0207938  1.32263270  0.9690704      0.9945993
##   [27,]  0.53303688 -0.9789225  1.32263270  0.9690704     -1.0047041
```

```
## attr(,"scaled:center")
##                             Age                           Gender
##                    4.631913e+01                     1.489531e+00
##                             BMI                            Fever
##                    2.860866e+01                     1.515523e+00
##                  Nausea.Vomting                         Headache
##                    1.502527e+00                     1.496029e+00
##                        Diarrhea Fatigue...generalized.bone.ache
##                    1.502527e+00                     1.498917e+00
##                        Jaundice                  Epigastric.pain
##                    1.501083e+00                     1.503971e+00
##                             WBC                              RBC
```

```
##                       7.533386e+03                       4.422130e+06
##                                HGB                               Plat
##                       1.258773e+01                       1.583481e+05
##                              AST.1                              ALT.1
##                       8.277473e+01                       8.391625e+01
##                               ALT4                             ALT.12
##                       8.340578e+01                       8.351047e+01
##                             ALT.24                             ALT.36
##                       8.370903e+01                       8.311769e+01
##                             ALT.48                    ALT.after.24.w
##                       8.362960e+01                       3.343827e+01
##                           RNA.Base                              RNA.4
##                       5.909512e+05                       6.008956e+05
##                             RNA.12                            RNA.EOT
##                       2.887536e+05                       2.876603e+05
##                             RNA.EF   Baseline.histological.Grading
##                       2.913783e+05                       9.761733e+00
##    Baselinehistological.staging
##                       2.536462e+00
## attr(,"scaled:scale")
##                                Age                             Gender
##                       8.781506e+00                       5.000709e-01
##                                BMI                              Fever
##                       4.076215e+00                       4.999395e-01
##                     Nausea.Vomting                           Headache
##                       5.001742e-01                       5.001648e-01
##                           Diarrhea Fatigue...generalized.bone.ache
##                       5.001742e-01                       5.001794e-01
##                           Jaundice                    Epigastric.pain
##                       5.001794e-01                       5.001648e-01
##                                WBC                                RBC
##                       2.668220e+03                       3.463577e+05
##                                HGB                               Plat
##                       1.713511e+00                       3.879479e+04
##                              AST.1                              ALT.1
##                       2.599324e+01                       2.592280e+01
##                               ALT4                             ALT.12
##                       2.652973e+01                       2.606448e+01
##                             ALT.24                             ALT.36
##                       2.620599e+01                       2.639903e+01
##                             ALT.48                    ALT.after.24.w
##                       2.622395e+01                       7.073569e+00
##                           RNA.Base                              RNA.4
##                       3.539354e+05                       3.623151e+05
##                             RNA.12                            RNA.EOT
##                       2.853507e+05                       2.645595e+05
##                             RNA.EF   Baseline.histological.Grading
##                       2.677007e+05                       4.023896e+00
##    Baselinehistological.staging
##                       1.121392e+00
```

```r
library(psych)
```




```r
fit.pc <- principal(HCV[1:29], nfactors=4, rotate="varimax")
fit.pc

## Principal Components Analysis
## Call: principal(r = HCV[1:29], nfactors = 4, rotate = "varimax")
## Standardized loadings (pattern matrix) based upon correlation matrix
##                                RC1   RC2   RC3   RC4    h2   u2 com
## Age                          -0.10  0.06 -0.05  0.27 0.091 0.91 1.4
## Gender                       -0.01  0.05  0.08 -0.09 0.017 0.98 2.6
## BMI                          -0.02 -0.04  0.15 -0.51 0.287 0.71 1.2
## Fever                         0.02  0.09  0.18  0.01 0.043 0.96 1.5
## Nausea.Vomting                0.05 -0.52  0.26  0.08 0.346 0.65 1.5
## Headache                     -0.02 -0.08  0.05  0.35 0.129 0.87 1.1
## Diarrhea                      0.03  0.03  0.35  0.16 0.148 0.85 1.5
## Fatigue...generalized.bone.ache  0.05  0.13  0.00 -0.02 0.021 0.98 1.3
## Jaundice                      0.04  0.07 -0.09  0.34 0.133 0.87 1.3
## Epigastric.pain               0.11  0.39  0.03 -0.09 0.169 0.83 1.3
## WBC                          -0.10  0.18 -0.09 -0.18 0.084 0.92 3.1
## RBC                          -0.06 -0.32 -0.04 -0.03 0.109 0.89 1.1
## HGB                           0.04 -0.17 -0.17 -0.41 0.227 0.77 1.7
## Plat                          0.11 -0.34  0.36 -0.15 0.281 0.72 2.6
## AST.1                        -0.04  0.01  0.07  0.00 0.007 0.99 1.6
## ALT.1                        -0.04 -0.08  0.58  0.11 0.356 0.64 1.1
## ALT4                          0.05 -0.10 -0.24  0.17 0.101 0.90 2.3
## ALT.12                       -0.08  0.04 -0.46  0.16 0.242 0.76 1.3
```

```
## ALT.24                            0.06 -0.38 -0.33  0.02 0.260 0.74 2.0
## ALT.36                            0.06 -0.07  0.01  0.19 0.044 0.96 1.5
## ALT.48                           -0.01  0.40  0.19  0.13 0.212 0.79 1.6
## ALT.after.24.w                    0.00  0.22  0.09  0.09 0.066 0.93 1.6
## RNA.Base                         -0.02  0.11  0.15  0.31 0.131 0.87 1.8
## RNA.4                            -0.07  0.19  0.01 -0.21 0.083 0.92 2.2
## RNA.12                            0.76  0.05  0.01  0.04 0.581 0.42 1.0
## RNA.EOT                           0.78  0.08 -0.04  0.00 0.613 0.39 1.0
## RNA.EF                            0.78  0.06 -0.03  0.05 0.620 0.38 1.0
## Baseline.histological.Grading   -0.07  0.16  0.04 -0.14 0.050 0.95 2.5
## Baselinehistological.staging      0.03 -0.20  0.03  0.28 0.118 0.88 1.9
##
##                        RC1  RC2  RC3  RC4
## SS loadings           1.88 1.25 1.22 1.22
## Proportion Var        0.06 0.04 0.04 0.04
## Cumulative Var        0.06 0.11 0.15 0.19
## Proportion Explained  0.34 0.22 0.22 0.22
## Cumulative Proportion 0.34 0.56 0.78 1.00
##
## Mean item complexity =  1.7
## Test of the hypothesis that 4 components are sufficient.
##
## The root mean square of the residuals (RMSR) is  0.06
##  with the empirical chi square  3895.88  with prob <  0
##
## Fit based upon off diagonal values = -0.68
```

```r
round(fit.pc$values, 3)
```

```
##  [1] 1.896 1.249 1.235 1.192 1.163 1.147 1.129 1.107 1.062 1.059 1.035
## [12] 1.028 1.024 1.010 0.985 0.974 0.962 0.959 0.928 0.908 0.885 0.866
## [23] 0.862 0.847 0.833 0.796 0.766 0.565 0.529
```

```r
fit.pc$loadings
```

```
##
## Loadings:
##                                  RC1    RC2    RC3    RC4
## Age                                                    0.275
## Gender
## BMI                                            0.147 -0.514
## Fever                                          0.183
## Nausea.Vomting                         -0.520  0.255
## Headache                                               0.347
## Diarrhea                                       0.346  0.165
## Fatigue...generalized.bone.ache         0.135
## Jaundice                                               0.343
## Epigastric.pain                   0.106  0.385
## WBC                              -0.105  0.180        -0.180
## RBC                                     -0.320
## HGB                                     -0.169 -0.172 -0.408
```

```
## Plat                                   0.112 -0.340  0.359 -0.154
## AST.1
## ALT.1                                                0.580  0.111
## ALT4                                         -0.104 -0.243  0.171
## ALT.12                                              -0.455  0.162
## ALT.24                                       -0.381 -0.334
## ALT.36                                                      0.190
## ALT.48                                        0.402  0.186  0.128
## ALT.after.24.w                                0.225
## RNA.Base                                      0.112  0.151  0.308
## RNA.4                                         0.189        -0.206
## RNA.12                                 0.759
## RNA.EOT                                0.778
## RNA.EF                                 0.783
## Baseline.histological.Grading                 0.158        -0.138
## Baselinehistological.staging                 -0.199         0.277
##
##                    RC1   RC2   RC3   RC4
## SS loadings    1.884 1.250 1.219 1.219
## Proportion Var 0.065 0.043 0.042 0.042
## Cumulative Var 0.065 0.108 0.150 0.192
```

```
# Loadings with more digits
for (i in c(1,3,2,4)) { print(fit.pc$loadings[[1,i]])}
```

```
## [1] -0.0958724
## [1] -0.04948666
## [1] 0.06362426
## [1] 0.2745433
```

```
# Communalities
fit.pc$communality
```

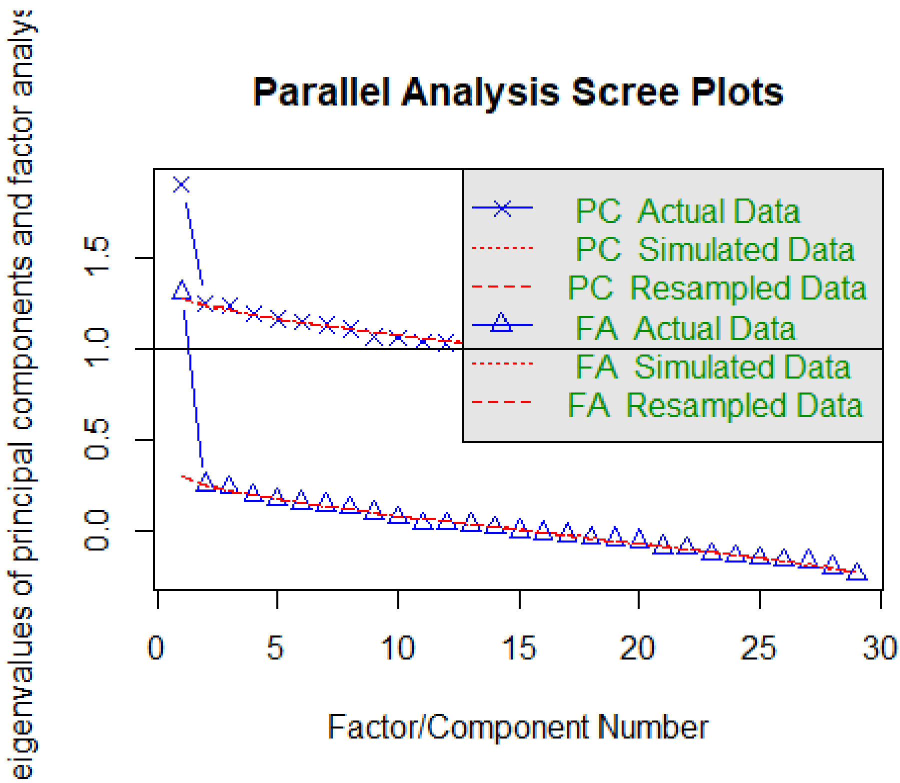
```
##                            Age                         Gender
##                    0.091062507                    0.017148673
##                            BMI                          Fever
##                    0.287460763                    0.042658501
##                 Nausea.Vomting                       Headache
##                    0.345852672                    0.129429831
##                       Diarrhea Fatigue...generalized.bone.ache
##                    0.148330647                    0.020932605
##                       Jaundice                Epigastric.pain
##                    0.133236702                    0.168757196
##                            WBC                            RBC
##                    0.084375524                    0.108709457
##                            HGB                           Plat
##                    0.226575779                    0.280929541
##                          AST.1                          ALT.1
##                    0.006993762                    0.356042693
##                           ALT4                         ALT.12
##                    0.101470264                    0.241949189
```

```
##                            ALT.24                          ALT.36
##                       0.260153753                     0.044408419
##                            ALT.48                ALT.after.24.w
##                       0.212487180                     0.066164981
##                          RNA.Base                           RNA.4
##                       0.131088563                     0.083108957
##                            RNA.12                         RNA.EOT
##                       0.581119980                     0.612871462
##                            RNA.EF    Baseline.histological.Grading
##                       0.619617868                     0.050100301
##    Baselinehistological.staging
##                       0.118334956
```

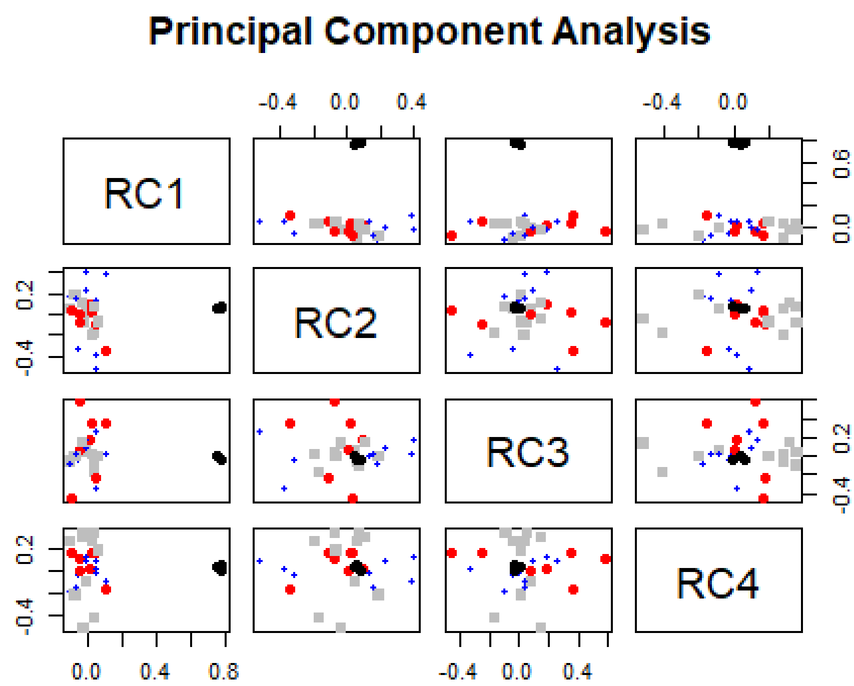
```r
# Rotated factor scores, Notice the columns ordering: RC1, RC3, RC2 and RC4
fit.pc$scores
```

```
##                 RC1          RC2           RC3          RC4
##    [1,] -1.0622643100  0.080761668 -1.5094106350 -1.962632045
##    [2,] -0.0026786175 -0.044020173  0.0736538382  0.886102392
##    [3,]  0.6996290407 -3.216649251 -1.4067382361 -0.057261850
##    [4,]  1.5163346531 -0.776414526 -0.1281427476  0.681424373
##    [5,]  4.9057352496  0.476636781  0.5326617845  0.313016961
##    [6,] -1.5191976947  0.402707723 -0.2361002782  1.890172046
##    [7,]  0.3715288048  0.243918957 -1.6544416873  0.508715596
##    [8,]  1.0528134353  0.282429290  1.0349324442  0.572492606
##    [9,] -0.4624751429  0.369648174 -0.6615023183  0.590944129
##   [10,]  0.2959360322  0.303746811 -1.0721971649  1.098803257
##   [11,]  0.5072113382  0.695569255  1.0678222322  1.621447274
##   [12,]  0.8254115604  0.458076783 -0.2398940534 -1.405320375
##   [13,] -1.2033769829  1.014090963  0.9403751880 -1.245043164
##   [14,]  1.1785640985 -0.271905934 -0.4626974933 -0.298366405
##   [15,]  0.1100394954 -0.289805069  1.3012403268 -0.563134500
##   [16,] -0.1863439454  0.279091024 -0.8554825546 -1.323897864
##   [17,] -1.3677347159 -0.953862198  1.3649506001  0.674939536
##   [18,]  0.3117828097  0.018360917 -0.0056293649  1.556618732
##   [19,]  0.7823548200 -0.657807268  1.3852125249  0.765636497
##   [20,]  0.9836496936  0.349039338  0.5334288872  1.673576535
##   [21,]  0.6756799086  0.411599173 -0.7863017569  0.876200476
##   [22,] -1.3528130191  0.296732421 -0.6216050314  1.033441596
##   [23,] -0.8954196002  0.212892557 -0.2961383286  0.921981624
##   [24,]  0.7115976706 -1.271476758  1.4876628894 -0.352473825
##   [25,]  0.6025828120  0.394462546  0.8027628881  0.636466590
##   [26,] -1.3885480928 -1.030634107  0.5949796104 -0.150762610
##   [27,]  1.4395069145  1.561371569 -0.8770405460 -0.728553346
##   [28,]  0.0552936021 -0.007343432  0.9477563169 -0.451740170
##   [29,] -1.2756600924 -0.847188753  0.5566900065  0.433490670
##   [30,]  0.7423287554  0.672957693 -1.8607013524 -0.525549256
##   [31,] -0.6595104332  0.686749854  0.1452406500 -1.149481326
##   [32,] -0.2485054317 -1.229862373  1.4107446897  0.815026590
##   [33,]  1.1758079231  1.387365844 -0.1315387113  0.188171397
```

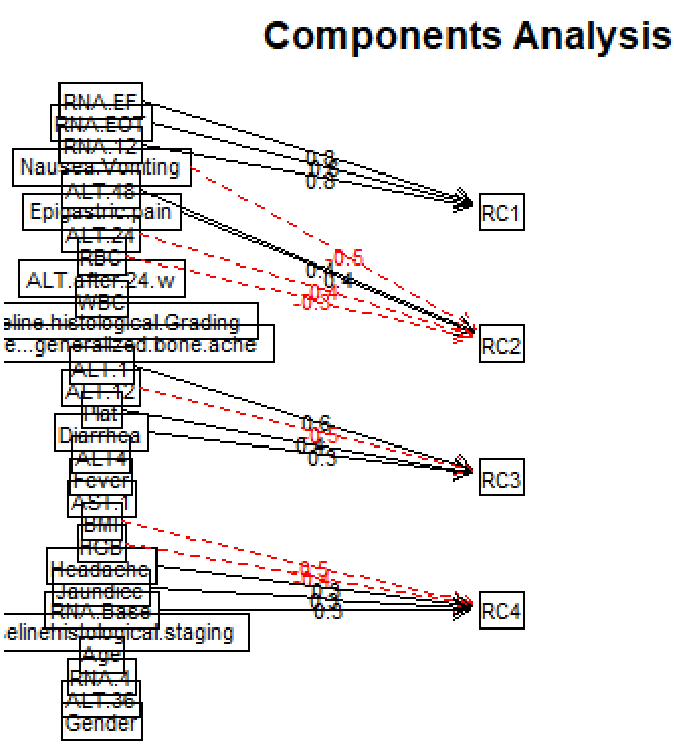
```
##   [34,]  0.0311235683 -0.219399571 -0.6624545051  0.098782267
##   [35,]  0.8008224945  1.339360078  1.0819966981  1.121787320
# Play with FA utilities

fa.parallel(HCV[1:29]) # See factor recommendation
```



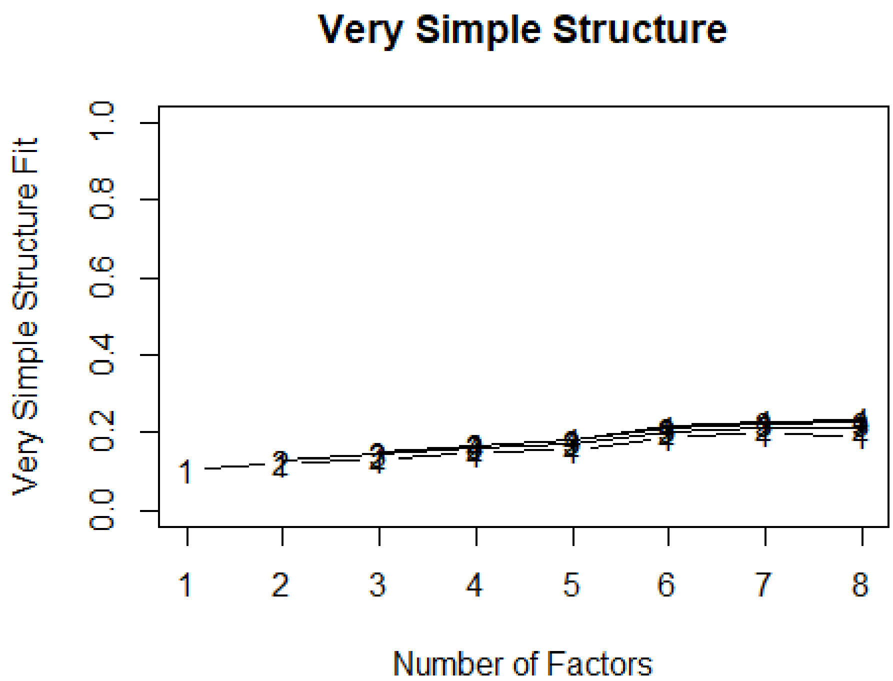

```
## Parallel analysis suggests that the number of factors =  1  and the number
of components =  1

fa.plot(fit.pc) # See Correlations within Factors
```




```r
fa.diagram(fit.pc) # Visualize the relationship
```




```r
vss(HCV[1:29]) # See Factor recommendations for a simple structure
```




```
##
## Very Simple Structure
## Call: vss(x = HCV[1:29])
## VSS complexity 1 achieves a maximimum of 0.2  with  7  factors
## VSS complexity 2 achieves a maximimum of 0.22  with  7  factors
##
## The Velicer MAP achieves a minimum of 0  with  1  factors
## BIC achieves a minimum of  -2353.19  with  1  factors
## Sample Size adjusted BIC achieves a minimum of  -1155.61  with  1  factors
##
## Statistics by number of factors
##   vss1 vss2    map dof chisq prob sqresid  fit RMSEA   BIC SABIC complex
## 1 0.11 0.00 0.0024 377   374 0.54      27 0.11     0 -2353 -1156     1.0
## 2 0.12 0.13 0.0038 349   327 0.80      27 0.13     0 -2198 -1089     1.3
## 3 0.13 0.14 0.0052 322   283 0.94      26 0.15     0 -2046 -1023     1.6
## 4 0.15 0.16 0.0068 296   248 0.98      26 0.17     0 -1893  -953     1.7
## 5 0.16 0.17 0.0085 271   221 0.99      25 0.18     0 -1740  -879     1.8
## 6 0.19 0.20 0.0104 247   189 1.00      24 0.22     0 -1598  -814     1.8
## 7 0.20 0.22 0.0123 224   157 1.00      23 0.24     0 -1464  -752     2.1
## 8 0.19 0.21 0.0145 202   133 1.00      23 0.24     0 -1328  -686     2.0
##   eChisq  SRMR eCRMS  eBIC
## 1    699 0.025 0.026 -2028
## 2    594 0.023 0.025 -1931
## 3    499 0.021 0.024 -1830
## 4    425 0.019 0.023 -1716
## 5    369 0.018 0.022 -1591
## 6    311 0.017 0.021 -1475
```

```
## 7     255 0.015 0.020 -1365
## 8     209 0.014 0.019 -1252
```