Successuful Aging

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# Successuful Aging

All files used here are availible in a public repository licensed under MIT Licences and accessible by the following url:

<https://github.com/crepeia/saging>

You can access the final report here:

<http://rpubs.com/leomartinsjf/saging>

Statistics consulting work was made by Leonardo Fernandes Martins. If you need help to understand, reproduce or cite this analysis - reach me out at:

[leomartinsjf@gmail.com](mailto:leomartinsjf@gmail.com)

# Loading required packages

# Preparing all data

#Setting Directory  
setwd("~/successful\_aging")  
  
#Importing SPSS file .sav  
base.dat <- read.spss("Base.sav", to.data.frame = T, use.missings = T)

# Selecting only working variables

saging <- base.dat[ ,c(3,6:27)]  
  
  
saging <- base.dat[ ,c(2,4,5,6,7,8,9,3,10:27)]  
  
#As dataframe  
saging<-as.data.frame(saging)  
  
#As factor  
  
saging[,c(1)]<-as.factor(saging[,c(1)])  
saging[,c(2)]<-as.factor(saging[,c(2)])  
saging[,c(3)]<-as.factor(saging[,c(3)])  
saging[,c(4)]<-as.factor(saging[,c(4)])  
saging[,c(5)]<-as.factor(saging[,c(5)])  
saging[,c(6)]<-as.factor(saging[,c(6)])  
saging[,c(7)]<-as.factor(saging[,c(7)])  
  
saging<-as.data.frame(saging)  
  
#As numeric  
for (i in c(7:26)) {  
saging[,c(i)]<-as.numeric(saging[,c(i)])  
}  
  
#Sabedoria  
saging$sabed<- saging$X.3dwscogAFC + saging$X.3dwsrefAFC + saging$X.3dwsafeAFC

# Variables Summary - Descriptive Stats

#Status Social Economic - Variables  
  
##Descriptive   
describe(saging)

## saging   
##   
## 27 Variables 303 Observations  
## ---------------------------------------------------------------------------  
## sexo   
## n missing unique   
## 303 0 2   
##   
## 1 (73, 24%), 2 (230, 76%)   
## ---------------------------------------------------------------------------  
## escol   
## n missing unique   
## 303 0 5   
##   
## 1 2 3 4 5  
## Frequency 66 130 31 38 38  
## % 22 43 10 13 13  
## ---------------------------------------------------------------------------  
## estcivil   
## n missing unique   
## 303 0 5   
##   
## 1 2 3 4 5  
## Frequency 123 35 26 114 5  
## % 41 12 9 38 2  
## ---------------------------------------------------------------------------  
## autosaude   
## n missing unique   
## 303 0 5   
##   
## 1 2 3 4 5  
## Frequency 56 115 118 9 5  
## % 18 38 39 3 2  
## ---------------------------------------------------------------------------  
## constab   
## n missing unique   
## 303 0 3   
##   
## 1 (23, 8%), 2 (75, 25%), 3 (205, 68%)   
## ---------------------------------------------------------------------------  
## consalco   
## n missing unique   
## 303 0 3   
##   
## 1 (251, 83%), 2 (50, 17%), 3 (2, 1%)   
## ---------------------------------------------------------------------------  
## consfrveg   
## n missing unique Info Mean   
## 303 0 4 0.67 1.389   
##   
## 1 (206, 68%), 2 (77, 25%), 3 (19, 6%), 4 (1, 0%)   
## ---------------------------------------------------------------------------  
## idade   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 32 1 70.79 61.0 62.0 65.0 70.0   
## .75 .90 .95   
## 75.0 82.0 85.9   
##   
## lowest : 60 61 62 63 64, highest: 87 88 89 91 99   
## ---------------------------------------------------------------------------  
## meemtotal   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 16 0.99 25.93 20 22 24 27   
## .75 .90 .95   
## 28 29 30   
##   
## 14 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30  
## Frequency 2 1 2 1 5 6 13 15 14 24 34 26 44 55 40 21  
## % 1 0 1 0 2 2 4 5 5 8 11 9 15 18 13 7  
## ---------------------------------------------------------------------------  
## voctotal   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 47 1 22.51 8.1 11.0 15.0 22.0   
## .75 .90 .95   
## 29.0 35.8 42.0   
##   
## lowest : 1 2 4 6 7, highest: 45 46 47 48 50   
## ---------------------------------------------------------------------------  
## rmtotal   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 25 0.99 7.079 1.0 2.2 4.0 6.0   
## .75 .90 .95   
## 8.0 15.0 19.0   
##   
## lowest : 0 1 2 3 4, highest: 20 21 22 23 24   
## ---------------------------------------------------------------------------  
## esvtotal   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 24 0.98 29.91 20 23 27 31   
## .75 .90 .95   
## 34 35 35   
##   
## lowest : 6 10 12 13 14, highest: 31 32 33 34 35   
## ---------------------------------------------------------------------------  
## partidtotal   
## n missing unique Info Mean   
## 303 0 6 0.9 1.086   
##   
## 0 1 2 3 4 5  
## Frequency 105 112 50 29 5 2  
## % 35 37 17 10 2 1  
## ---------------------------------------------------------------------------  
## eaertotal   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 19 0.99 32.24 26 27 29 32   
## .75 .90 .95   
## 35 38 39   
##   
## 19 22 23 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40  
## Frequency 1 1 2 7 7 17 15 27 40 20 27 17 32 24 15 18 15 5 13  
## % 0 0 1 2 2 6 5 9 13 7 9 6 11 8 5 6 5 2 4  
## ---------------------------------------------------------------------------  
## qsvpresenca   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 23 0.99 29.54 21 23 27 30   
## .75 .90 .95   
## 34 35 35   
##   
## lowest : 10 13 14 16 17, highest: 31 32 33 34 35   
## ---------------------------------------------------------------------------  
## qsvbusca   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 31 1 22.18 5.0 8.2 14.5 24.0   
## .75 .90 .95   
## 30.0 34.0 35.0   
##   
## lowest : 5 6 7 8 9, highest: 31 32 33 34 35   
## ---------------------------------------------------------------------------  
## qsvtotal   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 40 1 51.73 37.1 40.0 45.0 52.0   
## .75 .90 .95   
## 59.0 64.0 67.0   
##   
## lowest : 24 30 31 34 35, highest: 66 67 68 69 70   
## ---------------------------------------------------------------------------  
## qpdtotal   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 11 0.97 3.568 1 1 2 3   
## .75 .90 .95   
## 5 6 7   
##   
## 0 1 2 3 4 5 6 7 8 9 13  
## Frequency 5 42 50 58 57 47 19 19 3 2 1  
## % 2 14 17 19 19 16 6 6 1 1 0  
## ---------------------------------------------------------------------------  
## assptotal   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 12 0.96 17.26 12 13 15 18   
## .75 .90 .95   
## 20 20 20   
##   
## 8 10 11 12 13 14 15 16 17 18 19 20  
## Frequency 1 4 8 7 12 16 30 32 20 54 23 96  
## % 0 1 3 2 4 5 10 11 7 18 8 32  
## ---------------------------------------------------------------------------  
## aivdptotal   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 13 0.58 0.8911 0.0 0.0 0.0 0.0   
## .75 .90 .95   
## 0.5 2.8 5.0   
##   
## 0 1 2 3 4 5 6 7 8 9 11 17 18  
## Frequency 227 25 20 6 6 5 3 3 1 3 1 1 2  
## % 75 8 7 2 2 2 1 1 0 1 0 0 1  
## ---------------------------------------------------------------------------  
## gdstotal   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 13 0.98 3.29 0 1 2 3   
## .75 .90 .95   
## 4 6 7   
##   
## 0 1 2 3 4 5 6 7 8 9 11 13 14  
## Frequency 23 40 62 56 47 34 20 8 3 5 2 2 1  
## % 8 13 20 18 16 11 7 3 1 2 1 1 0  
## ---------------------------------------------------------------------------  
## qcspatotal   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 14 0.98 5.624 2 3 4 5   
## .75 .90 .95   
## 7 8 9   
##   
## 0 1 2 3 4 5 6 7 8 9 10 11 12 14  
## Frequency 2 2 15 28 56 53 41 49 32 11 7 3 2 2  
## % 1 1 5 9 18 17 14 16 11 4 2 1 1 1  
## ---------------------------------------------------------------------------  
## X.3dwscogAFC   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 26 1 2.726 1.571 1.857 2.286 2.714   
## .75 .90 .95   
## 3.286 3.829 4.000   
##   
## lowest : 1.000 1.143 1.286 1.571 1.714  
## highest: 4.143 4.286 4.429 4.571 4.857   
## ---------------------------------------------------------------------------  
## X.3dwsafeAFC   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 15 0.98 4.045 2.50 3.00 3.50 4.25   
## .75 .90 .95   
## 4.75 5.00 5.00   
##   
## 1 1.5 2 2.25 2.5 2.75 3 3.25 3.5 3.75 4 4.25 4.5 4.75 5  
## Frequency 2 1 9 1 4 8 13 19 32 16 37 48 31 17 65  
## % 1 0 3 0 1 3 4 6 11 5 12 16 10 6 21  
## ---------------------------------------------------------------------------  
## X.3dwsrefAFC   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 24 1 3.162 1.667 2.000 2.500 3.167   
## .75 .90 .95   
## 3.833 4.333 4.500   
##   
## lowest : 1.000 1.167 1.333 1.500 1.667  
## highest: 4.167 4.333 4.500 4.667 5.000   
## ---------------------------------------------------------------------------  
## X.3dwstotalAFC   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 241 1 3.311 2.240 2.460 2.944 3.365   
## .75 .90 .95   
## 3.734 4.065 4.238   
##   
## lowest : 1.159 1.222 1.333 1.540 1.817  
## highest: 4.500 4.508 4.603 4.698 4.841   
## ---------------------------------------------------------------------------  
## sabed   
## n missing unique Info Mean .05 .10 .25 .50   
## 303 0 242 1 9.933 6.719 7.379 8.833 10.095   
## .75 .90 .95   
## 11.202 12.195 12.713   
##   
## lowest : 3.476 3.667 4.000 4.619 5.452  
## highest: 13.500 13.524 13.810 14.095 14.524   
## ---------------------------------------------------------------------------

summary(saging)

## sexo escol estcivil autosaude constab consalco consfrveg   
## 1: 73 1: 66 1:123 1: 56 1: 23 1:251 Min. :1.000   
## 2:230 2:130 2: 35 2:115 2: 75 2: 50 1st Qu.:1.000   
## 3: 31 3: 26 3:118 3:205 3: 2 Median :1.000   
## 4: 38 4:114 4: 9 Mean :1.389   
## 5: 38 5: 5 5: 5 3rd Qu.:2.000   
## Max. :4.000   
## idade meemtotal voctotal rmtotal   
## Min. :60.00 Min. :14.00 Min. : 1.00 Min. : 0.000   
## 1st Qu.:65.00 1st Qu.:24.00 1st Qu.:15.00 1st Qu.: 4.000   
## Median :70.00 Median :27.00 Median :22.00 Median : 6.000   
## Mean :70.79 Mean :25.93 Mean :22.51 Mean : 7.079   
## 3rd Qu.:75.00 3rd Qu.:28.00 3rd Qu.:29.00 3rd Qu.: 8.000   
## Max. :99.00 Max. :30.00 Max. :50.00 Max. :24.000   
## esvtotal partidtotal eaertotal qsvpresenca   
## Min. : 6.00 Min. :0.000 Min. :19.00 Min. :10.00   
## 1st Qu.:27.00 1st Qu.:0.000 1st Qu.:29.00 1st Qu.:27.00   
## Median :31.00 Median :1.000 Median :32.00 Median :30.00   
## Mean :29.91 Mean :1.086 Mean :32.24 Mean :29.54   
## 3rd Qu.:34.00 3rd Qu.:2.000 3rd Qu.:35.00 3rd Qu.:34.00   
## Max. :35.00 Max. :5.000 Max. :40.00 Max. :35.00   
## qsvbusca qsvtotal qpdtotal assptotal   
## Min. : 5.00 Min. :24.00 Min. : 0.000 Min. : 8.00   
## 1st Qu.:14.50 1st Qu.:45.00 1st Qu.: 2.000 1st Qu.:15.00   
## Median :24.00 Median :52.00 Median : 3.000 Median :18.00   
## Mean :22.18 Mean :51.73 Mean : 3.568 Mean :17.26   
## 3rd Qu.:30.00 3rd Qu.:59.00 3rd Qu.: 5.000 3rd Qu.:20.00   
## Max. :35.00 Max. :70.00 Max. :13.000 Max. :20.00   
## aivdptotal gdstotal qcspatotal X.3dwscogAFC   
## Min. : 0.0000 Min. : 0.00 Min. : 0.000 Min. :1.000   
## 1st Qu.: 0.0000 1st Qu.: 2.00 1st Qu.: 4.000 1st Qu.:2.286   
## Median : 0.0000 Median : 3.00 Median : 5.000 Median :2.714   
## Mean : 0.8911 Mean : 3.29 Mean : 5.624 Mean :2.726   
## 3rd Qu.: 0.5000 3rd Qu.: 4.00 3rd Qu.: 7.000 3rd Qu.:3.286   
## Max. :18.0000 Max. :14.00 Max. :14.000 Max. :4.857   
## X.3dwsafeAFC X.3dwsrefAFC X.3dwstotalAFC sabed   
## Min. :1.000 Min. :1.000 Min. :1.159 Min. : 3.476   
## 1st Qu.:3.500 1st Qu.:2.500 1st Qu.:2.944 1st Qu.: 8.833   
## Median :4.250 Median :3.167 Median :3.365 Median :10.095   
## Mean :4.045 Mean :3.162 Mean :3.311 Mean : 9.933   
## 3rd Qu.:4.750 3rd Qu.:3.833 3rd Qu.:3.734 3rd Qu.:11.202   
## Max. :5.000 Max. :5.000 Max. :4.841 Max. :14.524

# Correlations among study variables

sagingcorr <- saging[ ,c("esvtotal", "autosaude", "gdstotal", "voctotal", "rmtotal", "qsvbusca", "qsvpresenca", "X.3dwstotalAFC", "qcspatotal")]  
#r<-tcor$r   
#r <- txtRound(r, 2)   
#r  
#htmlTable(r)  
  
sagingcorr[,c("autosaude")]<-as.numeric(sagingcorr[,c("autosaude")])  
tcor<-corr.test(sagingcorr)  
  
#p<-tcor$p  
#p <- txtRound(p, 2)  
#p  
#htmlTable(p) - only

# Structural Model

#Saging Model   
  
saging1 <- '  
# measurement model  
envels =~ esvtotal + autosaude + gdstotal  
  
  
# regressions  
envels ~ voctotal + rmtotal + qsvbusca + qsvpresenca + X.3dwstotalAFC + qcspatotal  
  
  
#Correlations and Residuals   
  
gdstotal ~~ gdstotal   
esvtotal ~~ esvtotal  
autosaude ~~ autosaude  
envels ~~ envels  
'  
  
#Model Fit  
fitsaging1 <- sem(saging1, estimator="WLSMVS", mimic = "Mplus", data = saging,  
 ordered=c("autosaude"))

## Found more than one class "Model" in cache; using the first, from namespace 'MatrixModels'

#Model Summary   
summary(fitsaging1, standardized=T, fit.measures=T, rsquare=T)

## lavaan (0.5-20) converged normally after 79 iterations  
##   
## Number of observations 303  
##   
## Estimator DWLS Robust  
## Minimum Function Test Statistic 28.940 35.696  
## Degrees of freedom 12 10  
## P-value (Chi-square) 0.004 0.000  
## Scaling correction factor 0.811  
## for the mean and variance adjusted correction (WLSMV)  
##   
## Model test baseline model:  
##   
## Minimum Function Test Statistic 230.281 165.031  
## Degrees of freedom 21 15  
## P-value 0.000 0.000  
##   
## User model versus baseline model:  
##   
## Comparative Fit Index (CFI) 0.919 0.829  
## Tucker-Lewis Index (TLI) 0.858 0.743  
##   
## Root Mean Square Error of Approximation:  
##   
## RMSEA 0.068 0.092  
## 90 Percent Confidence Interval 0.037 0.101 0.057 0.130  
## P-value RMSEA <= 0.05 0.153 0.025  
##   
## Weighted Root Mean Square Residual:  
##   
## WRMR 0.999 0.999  
##   
## Parameter Estimates:  
##   
## Information Expected  
## Standard Errors Robust.sem  
##   
## Latent Variables:  
## Estimate Std.Err Z-value P(>|z|) Std.lv Std.all  
## envels =~   
## esvtotal 1.000 3.255 0.628  
## autosaude -0.198 0.029 -6.859 0.000 -0.644 -0.610  
## gdstotal -0.479 0.072 -6.672 0.000 -1.560 -0.704  
##   
## Regressions:  
## Estimate Std.Err Z-value P(>|z|) Std.lv Std.all  
## envels ~   
## voctotal -0.030 0.028 -1.090 0.276 -0.009 -0.092  
## rmtotal 0.065 0.059 1.096 0.273 0.020 0.099  
## qsvbusca -0.034 0.027 -1.277 0.201 -0.010 -0.095  
## qsvpresenca 0.217 0.048 4.489 0.000 0.067 0.322  
## X.3dwstotalAFC 1.143 0.421 2.717 0.007 0.351 0.218  
## qcspatotal 0.267 0.100 2.662 0.008 0.082 0.184  
##   
## Intercepts:  
## Estimate Std.Err Z-value P(>|z|) Std.lv Std.all  
## esvtotal 18.960 2.239 8.470 0.000 18.960 3.656  
## autosaude 0.000 0.000 0.000  
## gdstotal 9.278 1.073 8.649 0.000 9.278 4.188  
## envels 0.000 0.000 0.000  
##   
## Thresholds:  
## Estimate Std.Err Z-value P(>|z|) Std.lv Std.all  
## autosaude|t1 -2.315 0.570 -4.062 0.000 -2.315 -2.192  
## autosaude|t2 -1.176 0.563 -2.088 0.037 -1.176 -1.114  
## autosaude|t3 0.454 0.541 0.839 0.401 0.454 0.430  
## autosaude|t4 0.909 0.572 1.588 0.112 0.909 0.861  
##   
## Variances:  
## Estimate Std.Err Z-value P(>|z|) Std.lv Std.all  
## gdstotal 2.473 0.314 7.888 0.000 2.473 0.504  
## esvtotal 16.306 1.541 10.585 0.000 16.306 0.606  
## autosaude 0.700 0.700 0.628  
## envels 7.657 1.637 4.679 0.000 0.723 0.723  
##   
## Scales y\*:  
## Estimate Std.Err Z-value P(>|z|) Std.lv Std.all  
## autosaude 1.000 1.000 1.000  
##   
## R-Square:  
## Estimate  
## gdstotal 0.496  
## esvtotal 0.394  
## autosaude 0.372  
## envels 0.277

#Model Fit Measures  
fitMeasures(fitsaging1, c("chisq","df","rmsea","rmsea.ci.lower", "rmsea.ci.upper", "srmr", "cfi", "tli", "nfi", "ecvi"))

## chisq df rmsea rmsea.ci.lower rmsea.ci.upper   
## 28.940 12.000 0.068 0.037 0.101   
## srmr cfi tli nfi ecvi   
## 1.224 0.919 0.858 0.874 NA

moreFitIndices(fitsaging1, fit.measures = "all", nPrior = 303)

## gammaHat adjGammaHat baseline.rmsea   
## 0.9639532 0.9819766 0.1813568

#Parameters Estimates  
EstPCA2rf <- parameterEstimates(fitsaging1, standardized=T, ci=F)  
subset(EstPCA2rf, op == "=~")

## lhs op rhs est se z pvalue std.lv std.all std.nox  
## 1 envels =~ esvtotal 1.000 0.000 NA NA 3.255 0.628 0.628  
## 2 envels =~ autosaude -0.198 0.029 -6.859 0 -0.644 -0.610 -0.610  
## 3 envels =~ gdstotal -0.479 0.072 -6.672 0 -1.560 -0.704 -0.704

#q <- txtRound(EstPCA2rf, 2) - Short script to genarete easy copy and paste tables  
#q  
#htmlTable(q)  
  
#Modification Index  
MIPCA2rf<-modindices(fitsaging1)  
MIIPCA2rf<- MIPCA2rf[which(MIPCA2rf$mi>10),]  
print(MIIPCA2rf)

## [1] lhs op rhs mi mi.scaled epc sepc.lv   
## [8] sepc.all sepc.nox   
## <0 rows> (or 0-length row.names)

#Model Plot  
semPaths(fitsaging1, what="path", whatLabels ="std", edge.label.cex = 0.7, exoVar = F, exoCov = T, layout = "tree2", optimizeLatRes=T, style = "lisrel", curve= 0.9, sizeLat = 5, sizeLat2 = 5, sizeMan = 3, sizeMan2 = 3, title = T, thresholds = F, curvePivot=T, intercepts = F, residuals = F)  
  
#Define Title  
title(main = "Figura 1. Modelo de Equação Estrutural para Envelhecimento Saudável(n=303)", line = 1)  
  
#Define Subtitle  
title(sub=chi^2~(31)==272.039 ~ "CFI=0.919; TLI=0.858; NFI=0.874; RMSEA=0.068; 90%CI(0.037-0.057)" , line = 3, font.sub = 1, cex.sub = 0.5)

