

Métodos Multivariados de Análise de Dados*

6ª Atividade

Alberson da Silva Miranda

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*Código disponível em https://github.com/albersonmiranda/analise_multivariada.

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1 CORREÇÃO

- Interpretação do teste χ^2 está invertida. É esperado que o teste seja não significativo para que o modelo seja aceito.
- Deveria ter revertido as variáveis inversas, pois afeta alguns testes.

2 INSTRUCTIONS

Complete the methods, results and conclusions session of the paper "One Should Not Be Flexible - One Should Be Strong: a Study on Work-Family Boundary Strength". A simplified version of the proposed model must be tested:

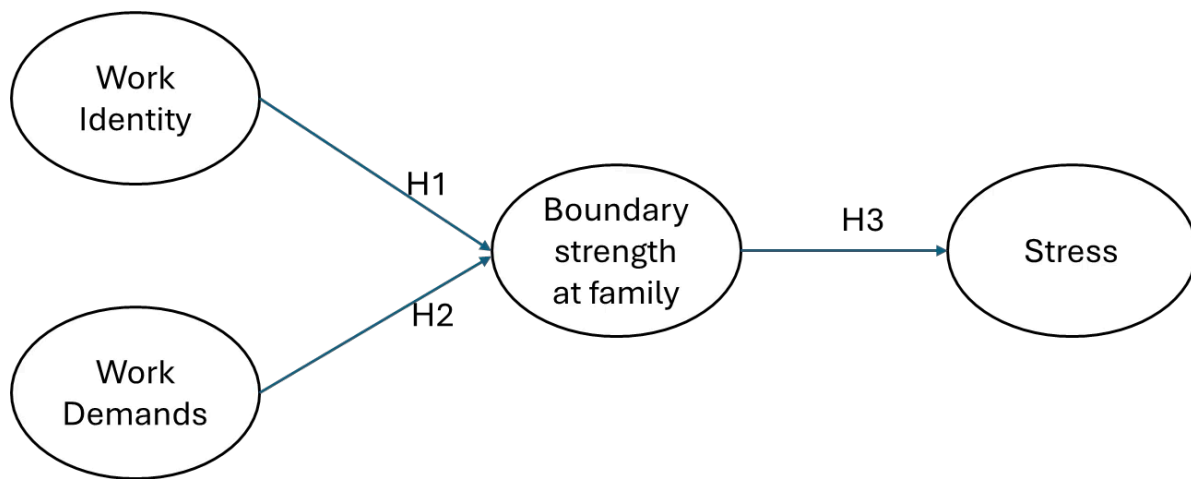


Figura 2.1: Model

First run a CFA for each “layer” of constructs (Work identity and Work demands together, then Boundary strength at Family and Stress independently).

Comment on any eventual changes made in the measurement models (i.e. exclusion of indicators). It is not allowed to correlate errors under any circumstance!

Run the structural model to test the hypotheses.

Report all relevant indicators and tests.

3 SCALES

3.1 CONSTRUCT: WORK DEMANDS

Source: Boyar, S. L., Carr, J. C., Mosley Jr., D. C., & Carson, C. M. (2007). The Development and Validation of Scores on Perceived Work and Family Demand Scales. *Educational & Psychological Measurement*, 67(1), 100-115.

Dem_Trab1 - I feel like I have a lot of work demand. Dem_Trab2 - My job requires all of my attention. Dem_Trab3 - My work requires a lot from me. Dem_Trab4 - I am given a lot of work to do.

3.2 CONSTRUCT: BOUNDARY STRENGTH AT FAMILY (BSF)

Source: Hecht, T. D., & Allen, N. J. (2009). A longitudinal examination of the work–nonwork boundary strength construct. *Journal of Organizational Behavior*, 30(7), 839-862. Retrieved from EBSCOhost.

Força_Fam_1_R - I often do work at home. (R) Força_Fam_2 - I never do work when I am with my family. Força_Fam_3 - I never take my work out of the “office.” Força_Fam_4_R - I often work “after hours.” (R) Força_Fam_5_R - I often deal with work-related issues when I am with my family (R) Força_Fam_6 – I don’t use family time for work-related matters.

3.3 CONSTRUCT: WORK IDENTITY

Source: Kanungo, R. N. (1982). Measurement of Job and Work Involvement. *Journal of Applied Psychology*, 67(3), 341-349.

Id_Trab_1 - The most important things that happen to me involve my present job Id_Trab_2_R - To me, my job is only a small part of who I am Id_Trab_3 - Most of my interests are centered around my job Id_Trab_4 - I like to be absorbed in my job most of the time Id_Trab_5 - Most of my personal life goals are job-oriented

3.4 CONSTRUCT: OCCUPATIONAL STRESS

Source: PASCHOAL, Tatiane; TAMAYO, Álvaro. Validação da escala de estresse no trabalho. Estud. psicol. (Natal), Natal, v. 9, n. 1, abr. 2004

Estresse_1 - Costumo ficar nervoso com a forma como as tarefas são distribuídas no meu setor de trabalho
Estresse_2 - A competição no meu ambiente de trabalho tem me deixado de mau humor
Estresse_3 - Fico irritado com discriminação/favoritismo/politicagem no meu ambiente de trabalho
Estresse_4 - Fico de mau humor por ter que trabalhar durante muitas horas seguidas
Estresse_5 - A falta de compreensão sobre quais são minhas responsabilidades no meu trabalho tem me causado irritação
Estresse_6 - Fico nervoso por ter um tempo insuficiente para realizar meu volume de trabalho

4 MÉTODOS

O primeiro passo é a importação dos dados.

```
1 # importação do dataset
2 dados <- haven::read_sav("data-raw/sem/Work_Family_Conflict_case_ok.sav")
3
4 # inverter variáveis reversas
5 dados$Forca_Fam_1_R <- 6 - dados$Forca_Fam_1_R
6 dados$Forca_Fam_4_R <- 6 - dados$Forca_Fam_4_R
7 dados$Forca_Fam_5_R <- 6 - dados$Forca_Fam_5_R
8 dados$Id_Trab_2_R <- 6 - dados$Id_Trab_2_R
```

Agora, a análise fatorial confirmatória. Para o construto Work Demands, o diagnóstico do modelo é positivo, com o construto se mostrando significativo estatisticamente ($p < 0.05$) e com um bom ajuste ($CFI > 0.95$, $RMSEA < 0.08$).

Em relação às cargas fatoriais, apenas Id_Trab_2_R foi excluída do modelo, pois não apresentou carga fatorial significativa (> 0.5).

```
1 # carregar pacotes
2 library(lavaan)
3 library(semPlot)
4
5 # CFA para Work Demands e Work Identity
6 modelo_work <- '
7   Work_Demands =~ Dem_Trab_1 + Dem_Trab_2 + Dem_Trab_3 + Dem_Trab_4
8   Work_Identity =~ Id_Trab_1 + Id_Trab_2_R + Id_Trab_3 + Id_Trab_4 + Id_Trab_5
9 '
10
11 cfa_work <- cfa(modelo_work, data = dados)
12 summary(cfa_work, fit.measures = TRUE, standardized = TRUE)
```

lavaan 0.6-19 ended normally after 33 iterations

Estimator

ML

Optimization method	NLMINB
Number of model parameters	19
Number of observations	401

Model Test User Model:

Test statistic	54.683
Degrees of freedom	26
P-value (Chi-square)	0.001

Model Test Baseline Model:

Test statistic	970.284
Degrees of freedom	36
P-value	0.000

User Model versus Baseline Model:

Comparative Fit Index (CFI)	0.969
Tucker-Lewis Index (TLI)	0.957

Loglikelihood and Information Criteria:

Loglikelihood user model (H0)	-5064.830
Loglikelihood unrestricted model (H1)	-5037.489
Akaike (AIC)	10167.660
Bayesian (BIC)	10243.545
Sample-size adjusted Bayesian (SABIC)	10183.257

Root Mean Square Error of Approximation:

RMSEA	0.052
90 Percent confidence interval - lower	0.033
90 Percent confidence interval - upper	0.072
P-value H ₀ : RMSEA ≤ 0.050	0.391
P-value H ₀ : RMSEA ≥ 0.080	0.009

Standardized Root Mean Square Residual:

SRMR	0.045
------	-------

Parameter Estimates:

Standard errors	Standard
Information	Expected
Information saturated (h1) model	Structured

Latent Variables:

	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
Work_Demands =~						
Dem_Trab_1	1.000				0.928	0.769
Dem_Trab_2	0.577	0.062	9.301	0.000	0.535	0.502
Dem_Trab_3	0.984	0.069	14.230	0.000	0.913	0.842
Dem_Trab_4	0.777	0.064	12.215	0.000	0.721	0.656
Work_Identity =~						
Id_Trab_1	1.000				0.607	0.557
Id_Trab_2_R	0.884	0.136	6.494	0.000	0.536	0.411
Id_Trab_3	1.271	0.134	9.496	0.000	0.771	0.766
Id_Trab_4	1.091	0.132	8.289	0.000	0.662	0.576
Id_Trab_5	1.216	0.133	9.128	0.000	0.738	0.682

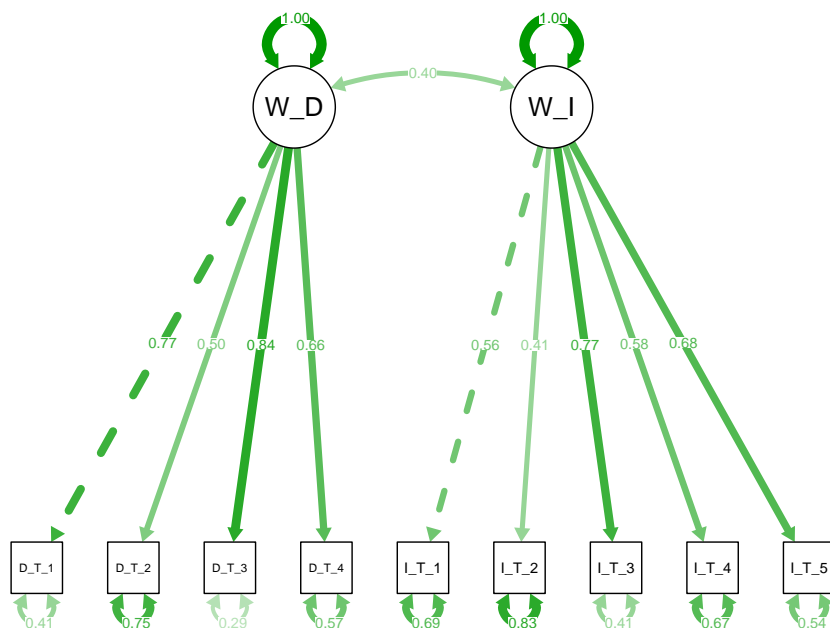
Covariances:

	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
Work_Demands ~~						
Work_Identity	0.227	0.042	5.334	0.000	0.403	0.403

Variances:

	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
.Dem_Trab_1	0.595	0.063	9.484	0.000	0.595	0.409
.Dem_Trab_2	0.850	0.064	13.200	0.000	0.850	0.748
.Dem_Trab_3	0.344	0.050	6.861	0.000	0.344	0.292
.Dem_Trab_4	0.686	0.058	11.911	0.000	0.686	0.569
.Id_Trab_1	0.818	0.066	12.329	0.000	0.818	0.690
.Id_Trab_2_R	1.412	0.106	13.348	0.000	1.412	0.831
.Id_Trab_3	0.418	0.050	8.296	0.000	0.418	0.413
.Id_Trab_4	0.882	0.073	12.130	0.000	0.882	0.668
.Id_Trab_5	0.627	0.060	10.497	0.000	0.627	0.535
Work_Demands	0.861	0.105	8.216	0.000	1.000	1.000
Work_Identity	0.368	0.069	5.342	0.000	1.000	1.000

```
1 semPaths(cfa_work, what = "std", title = TRUE)
```



Para o construto Boundary Strength at Family, o teste de significância foi positivo, com p-valor 0, mas CFI de apenas 92% e RMSEA de 0.15, o que não são bons indicadores. A carga fatorial Forca_Fam_3 é baixa e foi excluída do modelo.

```

1 # CFA para Boundary Strength at Family
2 modelo_bsf <- '
3   BSF =~ Forca_Fam_1_R + Forca_Fam_2 + Forca_Fam_3 + Forca_Fam_4_R + Forca_Fam_5_R + Forca_Fam_6
4 '
5
6 cfa_bsf <- cfa(modelo_bsf, data = dados)
7 summary(cfa_bsf, fit.measures = TRUE, standardized = TRUE)

```

lavaan 0.6-19 ended normally after 25 iterations

Estimator	ML
Optimization method	NLMINB
Number of model parameters	12
Number of observations	401

Model Test User Model:

Test statistic	89.417
Degrees of freedom	9

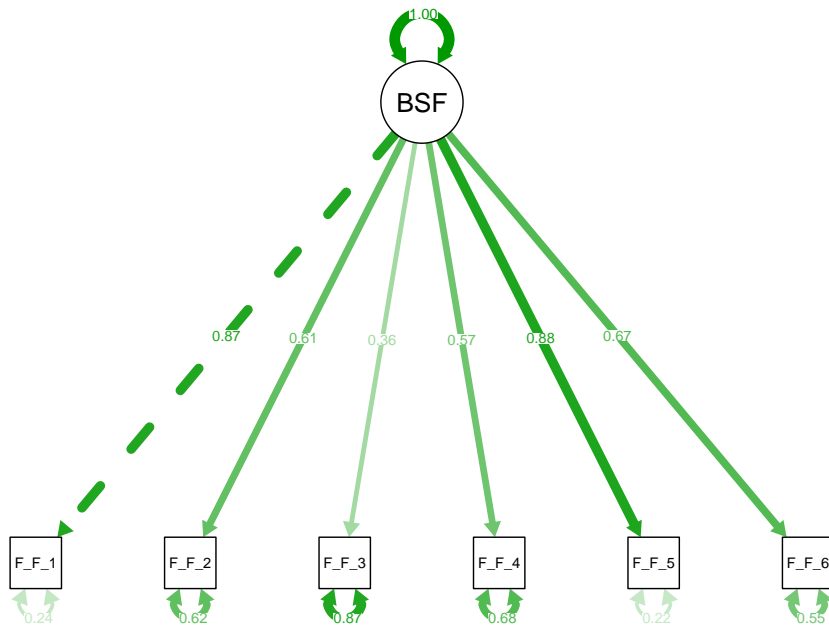
P-value (Chi-square)	0.000
Model Test Baseline Model:	
Test statistic	999.043
Degrees of freedom	15
P-value	0.000
User Model versus Baseline Model:	
Comparative Fit Index (CFI)	0.918
Tucker-Lewis Index (TLI)	0.864
Loglikelihood and Information Criteria:	
Loglikelihood user model (H0)	-3710.106
Loglikelihood unrestricted model (H1)	-3665.397
Akaike (AIC)	7444.212
Bayesian (BIC)	7492.140
Sample-size adjusted Bayesian (SABIC)	7454.063
Root Mean Square Error of Approximation:	
RMSEA	0.149
90 Percent confidence interval - lower	0.122
90 Percent confidence interval - upper	0.178
P-value H_0: RMSEA ≤ 0.050	0.000
P-value H_0: RMSEA ≥ 0.080	1.000
Standardized Root Mean Square Residual:	
SRMR	0.063
Parameter Estimates:	
Standard errors	Standard
Information	Expected
Information saturated (h1) model	Structured
Latent Variables:	
	Estimate Std.Err z-value P(> z) Std.lv Std.all
BSF =~	

Forca_Fam_1_R	1.000				1.219	0.874
Forca_Fam_2	0.689	0.052	13.228	0.000	0.840	0.615
Forca_Fam_3	0.406	0.056	7.206	0.000	0.495	0.364
Forca_Fam_4_R	0.656	0.055	11.971	0.000	0.800	0.568
Forca_Fam_5_R	0.993	0.047	21.233	0.000	1.210	0.881
Forca_Fam_6	0.717	0.048	14.924	0.000	0.874	0.673

Variances:

	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
.Forca_Fam_1_R	0.460	0.056	8.243	0.000	0.460	0.236
.Forca_Fam_2	1.162	0.088	13.157	0.000	1.162	0.622
.Forca_Fam_3	1.597	0.115	13.911	0.000	1.597	0.867
.Forca_Fam_4_R	1.346	0.101	13.378	0.000	1.346	0.678
.Forca_Fam_5_R	0.424	0.054	7.907	0.000	0.424	0.225
.Forca_Fam_6	0.921	0.072	12.777	0.000	0.921	0.546
BSF	1.487	0.141	10.536	0.000	1.000	1.000

```
1 semPaths(cfa_bsf, what = "std", title = TRUE)
```



Analisando os *modification indices*, temos algumas covariâncias que contribuiriam para o modelo e foram adicionadas. A inclusão dessas covariâncias foi capaz de melhorar o ajuste, com CFI de 0.99 e RMSEA de 0.07.

```
1 modindices(cfa_bsf)
```

	lhs	op	rhs	mi	epc	sepc.lv	sepc.all	sepc.nox
14	Forca_Fam_1_R	~	Forca_Fam_2	13.268	-0.199	-0.199	-0.273	-0.273
15	Forca_Fam_1_R	~	Forca_Fam_3	11.671	-0.191	-0.191	-0.223	-0.223
16	Forca_Fam_1_R	~	Forca_Fam_4_R	4.684	0.122	0.122	0.155	0.155
17	Forca_Fam_1_R	~	Forca_Fam_5_R	45.139	0.510	0.510	1.154	1.154
18	Forca_Fam_1_R	~	Forca_Fam_6	9.808	-0.166	-0.166	-0.254	-0.254
19	Forca_Fam_2	~	Forca_Fam_3	8.578	0.209	0.209	0.153	0.153
20	Forca_Fam_2	~	Forca_Fam_4_R	0.866	-0.063	-0.063	-0.050	-0.050
21	Forca_Fam_2	~	Forca_Fam_5_R	0.600	-0.042	-0.042	-0.060	-0.060
22	Forca_Fam_2	~	Forca_Fam_6	34.265	0.335	0.335	0.324	0.324
23	Forca_Fam_3	~	Forca_Fam_4_R	0.005	-0.005	-0.005	-0.004	-0.004
24	Forca_Fam_3	~	Forca_Fam_5_R	3.563	-0.104	-0.104	-0.126	-0.126
25	Forca_Fam_3	~	Forca_Fam_6	36.710	0.391	0.391	0.322	0.322
26	Forca_Fam_4_R	~	Forca_Fam_5_R	4.129	-0.113	-0.113	-0.149	-0.149
27	Forca_Fam_4_R	~	Forca_Fam_6	0.443	0.041	0.041	0.036	0.036
28	Forca_Fam_5_R	~	Forca_Fam_6	8.836	-0.155	-0.155	-0.249	-0.249

```
1 # CFA para Boundary Strength at Family
2 modelo_bsf <- '
3   BSF =~ Forca_Fam_1_R + Forca_Fam_2 + Forca_Fam_4_R + Forca_Fam_5_R + Forca_Fam_6
4   Forca_Fam_1_R =~ Forca_Fam_2
5   Forca_Fam_1_R =~ Forca_Fam_5_R
6   Forca_Fam_2 =~ Forca_Fam_6
7 '
8
9 cfa_bsf <- cfa(modelo_bsf, data = dados)
10 summary(cfa_bsf, fit.measures = TRUE, standardized = TRUE)
```

lavaan 0.6-19 ended normally after 29 iterations

Estimator	ML
Optimization method	NLMINB
Number of model parameters	13
Number of observations	401

Model Test User Model:

Test statistic	5.560
----------------	-------

Degrees of freedom	2
P-value (Chi-square)	0.062

Model Test Baseline Model:

Test statistic	907.128
Degrees of freedom	10
P-value	0.000

User Model versus Baseline Model:

Comparative Fit Index (CFI)	0.996
Tucker-Lewis Index (TLI)	0.980

Loglikelihood and Information Criteria:

Loglikelihood user model (H0)	-3022.734
Loglikelihood unrestricted model (H1)	-3019.954
Akaike (AIC)	6071.467
Bayesian (BIC)	6123.389
Sample-size adjusted Bayesian (SABIC)	6082.139

Root Mean Square Error of Approximation:

RMSEA	0.067
90 Percent confidence interval - lower	0.000
90 Percent confidence interval - upper	0.135
P-value H ₀ : RMSEA ≤ 0.050	0.256
P-value H ₀ : RMSEA ≥ 0.080	0.448

Standardized Root Mean Square Residual:

SRMR	0.014
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Parameter Estimates:

Standard errors	Standard
Information	Expected
Information saturated (h1) model	Structured

Latent Variables:

Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
----------	---------	---------	---------	--------	---------

BSF =~

Forca_Fam_1_R	1.000				1.220	0.874
Forca_Fam_2	0.683	0.075	9.168	0.000	0.833	0.610
Forca_Fam_4_R	0.671	0.072	9.332	0.000	0.818	0.580
Forca_Fam_5_R	0.958	0.048	20.026	0.000	1.169	0.850
Forca_Fam_6	0.691	0.072	9.635	0.000	0.843	0.650

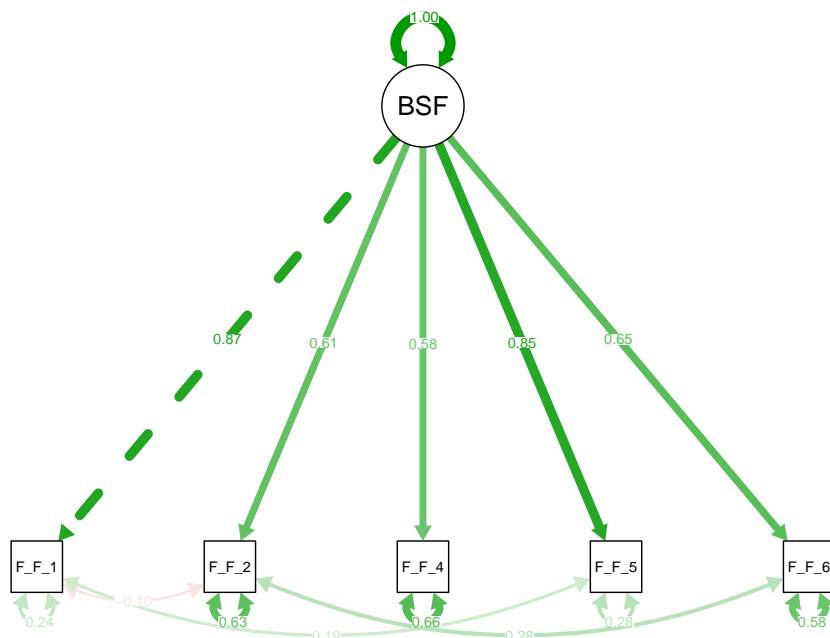
Covariances:

	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
.Forca_Fam_1_R ~~						
.Forca_Fam_2	-0.077	0.051	-1.510	0.131	-0.077	-0.105
.Forca_Fam_5_R	0.095	0.118	0.801	0.423	0.095	0.193
.Forca_Fam_2 ~~						
.Forca_Fam_6	0.299	0.080	3.720	0.000	0.299	0.280

Variances:

	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
.Forca_Fam_1_R	0.460	0.135	3.403	0.001	0.460	0.236
.Forca_Fam_2	1.170	0.107	10.950	0.000	1.170	0.628
.Forca_Fam_4_R	1.317	0.107	12.317	0.000	1.317	0.663
.Forca_Fam_5_R	0.523	0.124	4.231	0.000	0.523	0.277
.Forca_Fam_6	0.973	0.092	10.637	0.000	0.973	0.578
BSF	1.487	0.187	7.943	0.000	1.000	1.000

```
1 semPaths(cfa_bsf, what = "std", title = TRUE)
```



Para o construto Occupational Stress, o teste de significância foi negativo, com p-valor de 36%, apesar de um CFI de 0.99 e RMSEA de 0.16.

```

1 # CFA para Occupational Stress
2 modelo_stress <- '
3   Stress =~ Estresse_1 + Estresse_2 + Estresse_3 + Estresse_4 + Estresse_5 + Estresse_6
4 '
5
6 cfa_stress <- cfa(modelo_stress, data = dados)
7 summary(cfa_stress, fit.measures = TRUE, standardized = TRUE)

```

lavaan 0.6-19 ended normally after 27 iterations

Estimator	ML
Optimization method	NLMINB
Number of model parameters	12
Number of observations	401

Model Test User Model:

Test statistic	9.910
Degrees of freedom	9
P-value (Chi-square)	0.358

Model Test Baseline Model:

Test statistic	332.366
Degrees of freedom	15
P-value	0.000

User Model versus Baseline Model:

Comparative Fit Index (CFI)	0.997
Tucker-Lewis Index (TLI)	0.995

Loglikelihood and Information Criteria:

Loglikelihood user model (H0)	-3872.277
Loglikelihood unrestricted model (H1)	-3867.322
Akaike (AIC)	7768.553
Bayesian (BIC)	7816.481
Sample-size adjusted Bayesian (SABIC)	7778.404

Root Mean Square Error of Approximation:

RMSEA	0.016
90 Percent confidence interval - lower	0.000
90 Percent confidence interval - upper	0.060
P-value H ₀ : RMSEA ≤ 0.050	0.879
P-value H ₀ : RMSEA ≥ 0.080	0.004

Standardized Root Mean Square Residual:

SRMR	0.025
------	-------

Parameter Estimates:

Standard errors	Standard
Information	Expected
Information saturated (h1) model	Structured

Latent Variables:

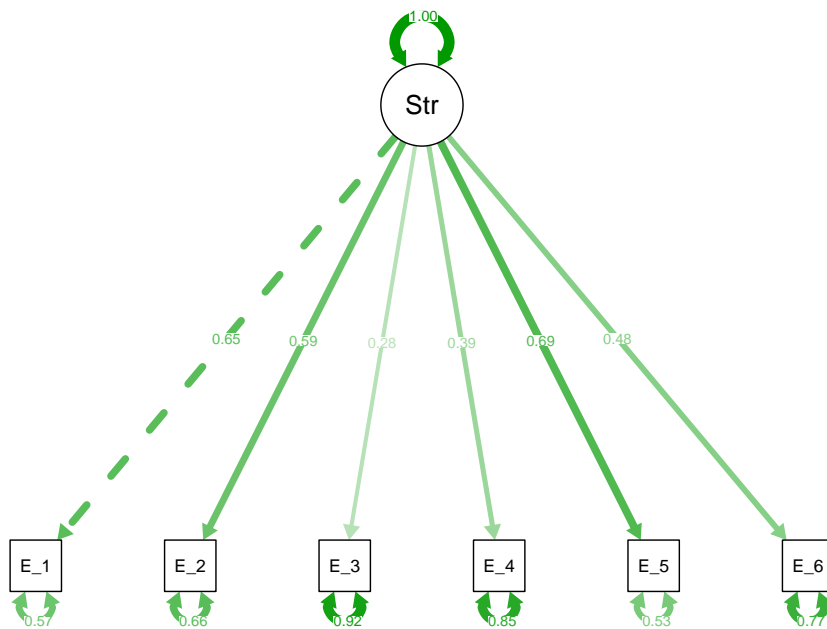
	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
Stress =~						
Estresse_1	1.000				0.870	0.652

Estresse_2	0.910	0.107	8.541	0.000	0.791	0.586
Estresse_3	0.351	0.075	4.673	0.000	0.305	0.283
Estresse_4	0.595	0.095	6.237	0.000	0.518	0.391
Estresse_5	1.090	0.119	9.173	0.000	0.948	0.685
Estresse_6	0.722	0.098	7.336	0.000	0.628	0.475

Variances:

	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
.Estresse_1	1.023	0.101	10.089	0.000	1.023	0.575
.Estresse_2	1.195	0.106	11.314	0.000	1.195	0.656
.Estresse_3	1.067	0.078	13.701	0.000	1.067	0.920
.Estresse_4	1.486	0.113	13.205	0.000	1.486	0.847
.Estresse_5	1.013	0.109	9.303	0.000	1.013	0.530
.Estresse_6	1.349	0.107	12.601	0.000	1.349	0.774
Stress	0.756	0.125	6.049	0.000	1.000	1.000

```
1 semPaths(cfa_stress, what = "std", title = TRUE)
```



Testando as covariâncias, nenhuma é grande o suficiente para ser incluída no modelo. Além disso, mesmo removendo os indicadores de cargas fatoriais baixas, Estresse_3 e Estresse_4, o teste de significância ainda não se mostrou significativo. Entretanto, tendo as demais métricas positivas, seguiremos com o construto.

```
1 modindices(cfa_stress)
```

	lhs	op	rhs	mi	epc	sepc.lv	sepc.all	sepc.nox
14	Estresse_1	~	Estresse_2	3.337	-0.164	-0.164	-0.148	-0.148
15	Estresse_1	~	Estresse_3	1.039	0.065	0.065	0.062	0.062
16	Estresse_1	~	Estresse_4	0.293	-0.043	-0.043	-0.035	-0.035
17	Estresse_1	~	Estresse_5	2.272	0.158	0.158	0.155	0.155
18	Estresse_1	~	Estresse_6	0.022	0.012	0.012	0.010	0.010
19	Estresse_2	~	Estresse_3	0.103	-0.021	-0.021	-0.018	-0.018
20	Estresse_2	~	Estresse_4	0.006	0.006	0.006	0.005	0.005
21	Estresse_2	~	Estresse_5	0.857	0.089	0.089	0.081	0.081
22	Estresse_2	~	Estresse_6	1.490	0.097	0.097	0.077	0.077
23	Estresse_3	~	Estresse_4	0.340	0.039	0.039	0.031	0.031
24	Estresse_3	~	Estresse_5	0.056	-0.016	-0.016	-0.015	-0.015
25	Estresse_3	~	Estresse_6	1.333	-0.075	-0.075	-0.063	-0.063
26	Estresse_4	~	Estresse_5	0.948	-0.081	-0.081	-0.066	-0.066
27	Estresse_4	~	Estresse_6	2.917	0.135	0.135	0.095	0.095
28	Estresse_5	~	Estresse_6	3.088	-0.150	-0.150	-0.128	-0.128

```
1 # CFA para Occupational Stress
2 modelo_stress <- '
3   Stress =~ Estresse_1 + Estresse_2 + Estresse_5 + Estresse_6
4   '
5
6 cfa_stress <- cfa(modelo_stress, data = dados)
7 summary(cfa_stress, fit.measures = TRUE, standardized = TRUE)
```

lavaan 0.6-19 ended normally after 28 iterations

Estimator	ML
Optimization method	NLMINB
Number of model parameters	8
Number of observations	401

Model Test User Model:

Test statistic	4.399
Degrees of freedom	2
P-value (Chi-square)	0.111

Model Test Baseline Model:

Test statistic	257.793
Degrees of freedom	6
P-value	0.000

User Model versus Baseline Model:

Comparative Fit Index (CFI)	0.990
Tucker-Lewis Index (TLI)	0.971

Loglikelihood and Information Criteria:

Loglikelihood user model (H0)	-2626.227
Loglikelihood unrestricted model (H1)	-2624.027
Akaike (AIC)	5268.453
Bayesian (BIC)	5300.405
Sample-size adjusted Bayesian (SABIC)	5275.020

Root Mean Square Error of Approximation:

RMSEA	0.055
90 Percent confidence interval - lower	0.000
90 Percent confidence interval - upper	0.126
P-value H ₀ : RMSEA ≤ 0.050	0.354
P-value H ₀ : RMSEA ≥ 0.080	0.342

Standardized Root Mean Square Residual:

SRMR	0.021
------	-------

Parameter Estimates:

Standard errors	Standard
Information	Expected
Information saturated (h1) model	Structured

Latent Variables:

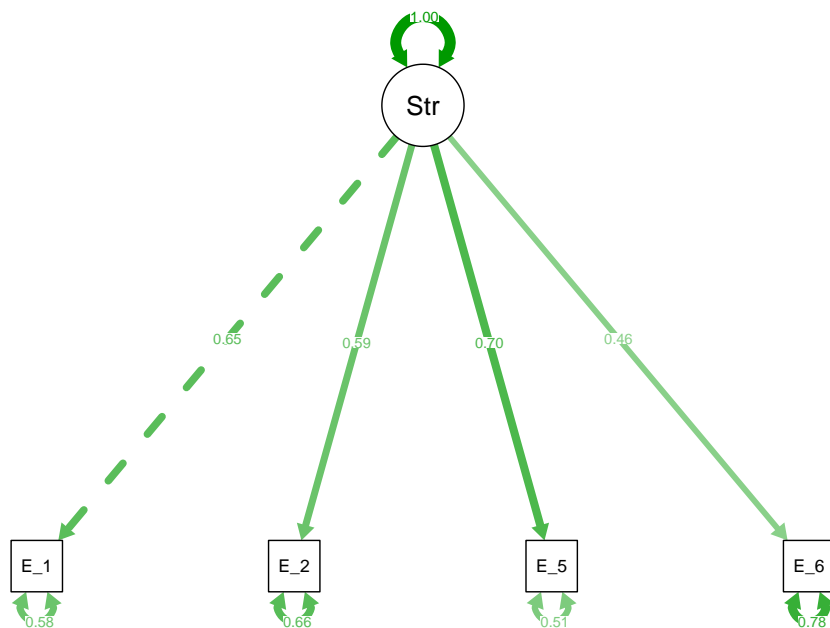
	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
Stress =~						
Estresse_1	1.000				0.862	0.646
Estresse_2	0.917	0.112	8.199	0.000	0.790	0.586

Estresse_5	1.123	0.131	8.564	0.000	0.968	0.700
Estresse_6	0.711	0.102	6.989	0.000	0.613	0.464

Variances:

	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
.Estresse_1	1.036	0.107	9.684	0.000	1.036	0.582
.Estresse_2	1.196	0.109	10.985	0.000	1.196	0.657
.Estresse_5	0.974	0.118	8.255	0.000	0.974	0.510
.Estresse_6	1.367	0.109	12.541	0.000	1.367	0.784
Stress	0.744	0.129	5.784	0.000	1.000	1.000

```
1 semPaths(cfa_stress, what = "std", title = TRUE)
```



Por fim, o modelo estrutural. As hipóteses são confirmadas, com BSF influenciando Work Identity e Work Demands, e Stress influenciado por BSF e Work Demands. As cargas fatoriais são altas e os coeficientes de regressão são significativos.

```

1 # Modelo estrutural
2 modelo_structural <- '
3   Work_Demands =~ Dem_Trab_1 + Dem_Trab_2 + Dem_Trab_3 + Dem_Trab_4
4   Work_Identity =~ Id_Trab_1 + Id_Trab_3 + Id_Trab_4 + Id_Trab_5
5   BSF =~ Forca_Fam_1_R + Forca_Fam_2 + Forca_Fam_4_R + Forca_Fam_5_R + Forca_Fam_6
6   Stress =~ Estresse_1 + Estresse_2 + Estresse_5 + Estresse_6
7
```

```

8   Forca_Fam_1_R ~ Forca_Fam_2
9   Forca_Fam_1_R ~ Forca_Fam_5_R
10  Forca_Fam_2 ~ Forca_Fam_6
11
12  # Hipóteses
13  BSF ~ Work_Identity + Work_Demands
14  Stress ~ BSF + Work_Demands
15  '
16
17  sem_model <- sem(modelo_structural, data = dados)
18  summary(sem_model, fit.measures = TRUE, standardized = TRUE)

```

lavaan 0.6-19 ended normally after 44 iterations

Estimator	ML
Optimization method	NLMINB
Number of model parameters	42
Number of observations	401

Model Test User Model:

Test statistic	225.377
Degrees of freedom	111
P-value (Chi-square)	0.000

Model Test Baseline Model:

Test statistic	2342.188
Degrees of freedom	136
P-value	0.000

User Model versus Baseline Model:

Comparative Fit Index (CFI)	0.948
Tucker-Lewis Index (TLI)	0.936

Loglikelihood and Information Criteria:

Loglikelihood user model (H0)	-10015.323
Loglikelihood unrestricted model (H1)	-9902.635

Akaike (AIC)	20114.646
Bayesian (BIC)	20282.393
Sample-size adjusted Bayesian (SABIC)	20149.123

Root Mean Square Error of Approximation:

RMSEA	0.051
90 Percent confidence interval - lower	0.041
90 Percent confidence interval - upper	0.060
P-value H ₀ : RMSEA ≤ 0.050	0.439
P-value H ₀ : RMSEA ≥ 0.080	0.000

Standardized Root Mean Square Residual:

SRMR	0.061
------	-------

Parameter Estimates:

Standard errors	Standard
Information	Expected
Information saturated (h1) model	Structured

Latent Variables:

	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
Work_Demands =~						
Dem_Trab_1	1.000				0.938	0.777
Dem_Trab_2	0.565	0.061	9.308	0.000	0.530	0.497
Dem_Trab_3	0.969	0.065	14.841	0.000	0.909	0.837
Dem_Trab_4	0.767	0.062	12.373	0.000	0.719	0.655
Work_Identity =~						
Id_Trab_1	1.000				0.586	0.538
Id_Trab_3	1.344	0.148	9.105	0.000	0.788	0.783
Id_Trab_4	1.143	0.141	8.119	0.000	0.670	0.583
Id_Trab_5	1.248	0.142	8.784	0.000	0.732	0.676
BSF =~						
Forca_Fam_1_R	1.000				1.200	0.860
Forca_Fam_2	0.679	0.068	9.955	0.000	0.815	0.596
Forca_Fam_4_R	0.719	0.068	10.642	0.000	0.863	0.612
Forca_Fam_5_R	0.942	0.046	20.519	0.000	1.131	0.823
Forca_Fam_6	0.705	0.065	10.919	0.000	0.846	0.652
Stress =~						
Estresse_1	1.000				0.852	0.639
Estresse_2	0.932	0.112	8.294	0.000	0.794	0.589

Estresse_5	1.064	0.122	8.712	0.000	0.907	0.656
Estresse_6	0.815	0.106	7.716	0.000	0.695	0.526

Regressions:

	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
BSF ~						
Work_Identity	-0.229	0.134	-1.706	0.088	-0.112	-0.112
Work_Demands	-0.482	0.084	-5.760	0.000	-0.377	-0.377
Stress ~						
BSF	-0.139	0.051	-2.724	0.006	-0.196	-0.196
Work_Demands	0.277	0.068	4.100	0.000	0.305	0.305

Covariances:

	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
.Forca_Fam_1_R ~~						
.Forca_Fam_2	-0.055	0.049	-1.135	0.256	-0.055	-0.071
.Forca_Fam_5_R	0.165	0.094	1.762	0.078	0.165	0.296
.Forca_Fam_2 ~~						
.Forca_Fam_6	0.314	0.074	4.234	0.000	0.314	0.291
Work_Demands ~~						
Work_Identity	0.213	0.041	5.149	0.000	0.388	0.388

Variances:

	Estimate	Std.Err	z-value	P(> z)	Std.lv	Std.all
.Dem_Trab_1	0.576	0.060	9.563	0.000	0.576	0.396
.Dem_Trab_2	0.855	0.064	13.265	0.000	0.855	0.753
.Dem_Trab_3	0.352	0.047	7.437	0.000	0.352	0.299
.Dem_Trab_4	0.688	0.057	12.052	0.000	0.688	0.571
.Id_Trab_1	0.842	0.068	12.440	0.000	0.842	0.710
.Id_Trab_3	0.392	0.053	7.405	0.000	0.392	0.387
.Id_Trab_4	0.871	0.073	11.955	0.000	0.871	0.660
.Id_Trab_5	0.636	0.061	10.398	0.000	0.636	0.543
.Forca_Fam_1_R	0.508	0.109	4.676	0.000	0.508	0.261
.Forca_Fam_2	1.202	0.104	11.583	0.000	1.202	0.644
.Forca_Fam_4_R	1.241	0.102	12.191	0.000	1.241	0.625
.Forca_Fam_5_R	0.611	0.102	5.963	0.000	0.611	0.323
.Forca_Fam_6	0.968	0.086	11.303	0.000	0.968	0.575
.Estresse_1	1.053	0.104	10.150	0.000	1.053	0.592
.Estresse_2	1.190	0.107	11.099	0.000	1.190	0.653
.Estresse_5	1.088	0.111	9.770	0.000	1.088	0.570
.Estresse_6	1.260	0.105	11.973	0.000	1.260	0.723
Work_Demands	0.880	0.104	8.431	0.000	1.000	1.000
Work_Identity	0.344	0.067	5.109	0.000	1.000	1.000

.BSF	1.171	0.146	8.012	0.000	0.813	0.813
.Stress	0.595	0.105	5.641	0.000	0.818	0.818

```
1 semPaths(sem_model, what = "std", title = TRUE)
```

