Behavior and Attitude Towards Mental Health in the Technology Workplace: Confirmatory Factor Analysis

EPPS 7318: Structural Equation and Multilevel (Hierarchical) Modeling

Why focus on mental health in the tech workplace?

- Mental health needs to be addressed by employers in order to support the work environment (Joyce at al. 2016)
- Difficult to address mental health due to stigma in the workplace (Krupa et al. 2009)
- Study determined that employees with serious mental illness are aware when they face discrimination (Baldwin and Marcus 2006)
- Knowledge, attitudes, and behavior are three problems that cause mental health stigma (Brohan and Thornicroft 2010)

Data: Open Sourcing Mental Illness (OSMI)

- Non-profit conducting annual Mental Health in Tech Survey
  - Understand and examine mental health concerns in the tech community
- Raw data used from 2019 version of survey
  - Missing values
- Sample size of 352 participants
- Includes 82 different survey questions
  - Likert Scale survey questions

Variables

```
. su
```

Variable	Obs	Mean	Std. Dev.	Min	Max
emp_phi	304	6.328947	2.298734	0	10
emp_mhi	304	4.878289	2.609007	0	10
pemp_phi	296	5.587838	2.549653	0	10
pemp_mhi	296	3.527027	2.418701	0	10
share_ff	352	6.272727	2.65908	0	10
a_career	18	3.833333	2.202939	0	8
work_react	352	5.275568	2.208679	0	10
support	352	2.602273	.9641999	1	5

Spearman’s Correlation

- Ordinal variables with a monotonic relationship

```
. spearman work_react emp_mhi

 Number of obs =       304
Spearman's rho =    0.3801

Test of Ho: work_react and emp_mhi are independent
    Prob > |t| =    0.0000
```

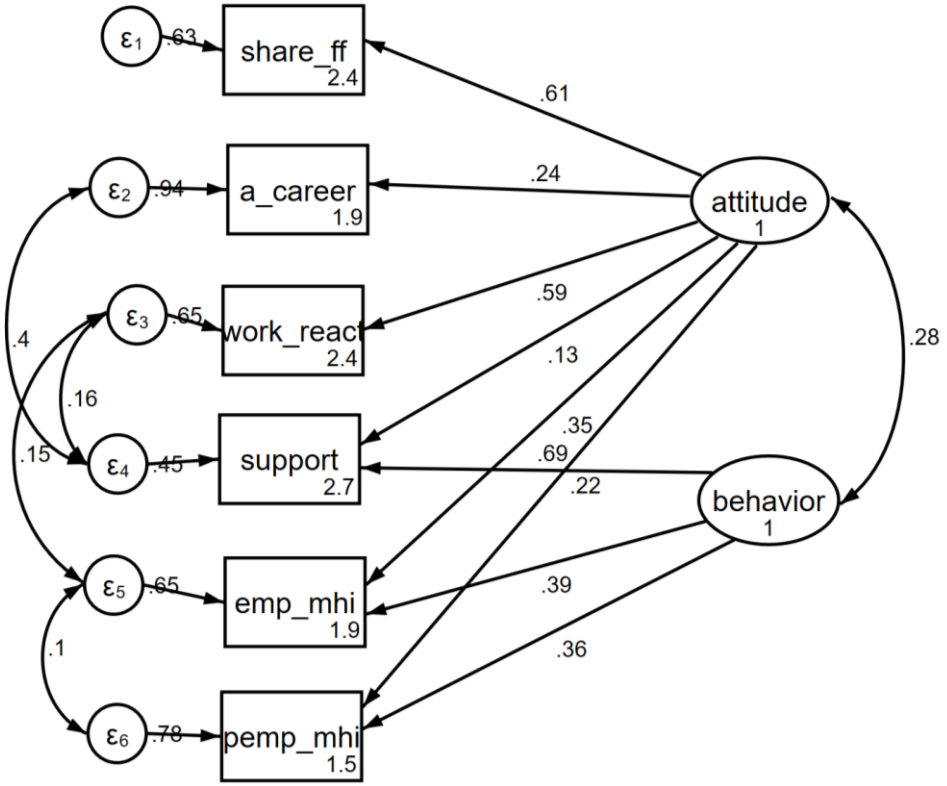
- Spearman’s correlation coefficient indicates a mediocre monotonic relationship among variables
  - Results are statistically significant

Hypothesis and Variables

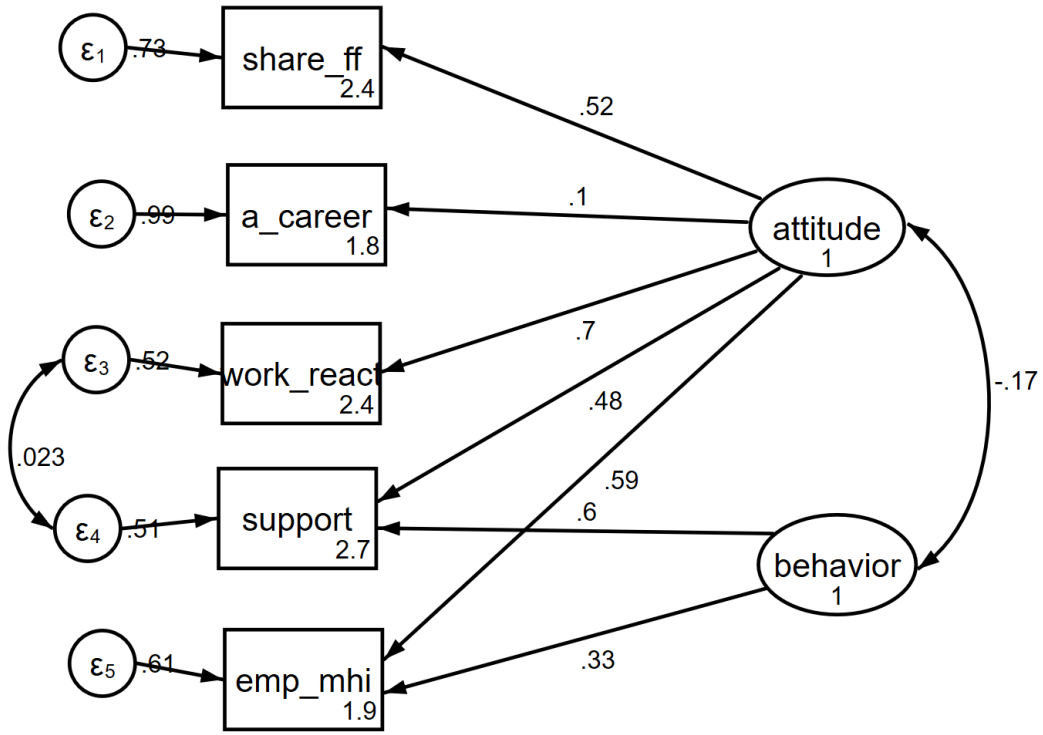
- 2 models with 2 exogenous latent constructs which covary
  - Hypothesis: survey questions accurately measure **attitude** and **behavior** towards mental health
- Error covariances only observed between:
  - support and work_react
- Error covariances observed between:
  - support and work_react
  - support and a_career
  - emp_mhi and work_react
  - emp_mhi and pemp_mhi
- Behavior concerning mental health
  - emp_mhi
  - support
    - pemp_mhi
- Attitude towards mental health
  - support
  - work_react
  - a_career
  - share_ff
  - emp_mhi
    - pemp_mhi

Confirmatory Factor Analysis

Model 1



Model 2



Goodness of Fit

Model 1

```
. estat gof, stats(all)
```

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(1)	6.194	model vs. saturated
p > chi2	0.013	
chi2_bs(15)	226.947	baseline vs. saturated
p > chi2	0.000	
Population error		
RMSEA	0.122	Root mean squared error of approximation
90% CI, lower bound	0.045	
upper bound	0.221	
pclose	0.061	Probability RMSEA <= 0.05
Information criteria		
AIC	6930.854	Akaike's information criterion
BIC	7031.308	Bayesian information criterion
Baseline comparison		
CFI	0.975	Comparative fit index
TLI	0.632	Tucker-Lewis index
Size of residuals		
CD	0.839	Coefficient of determination

Note: SRMR is not reported because of missing values.

Model 2

```
. estat gof, stats(all)
```

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(1)	4.798	model vs. saturated
p > chi2	0.028	
chi2_bs(10)	170.824	baseline vs. saturated
p > chi2	0.000	
Population error		
RMSEA	0.104	Root mean squared error of approximation
90% CI, lower bound	0.027	
upper bound	0.205	
pclose	0.106	Probability RMSEA <= 0.05
Information criteria		
AIC	5609.699	Akaike's information criterion
BIC	5683.108	Bayesian information criterion
Baseline comparison		
CFI	0.976	Comparative fit index
TLI	0.764	Tucker-Lewis index
Size of residuals		
CD	0.807	Coefficient of determination

Note: SRMR is not reported because of missing values.

Method of Analysis

- Confirmatory Factor Analysis demonstrates that the second model is better based on both a lower AIC and BIC and a higher CFI and TLI, however, the RMSEA is a poor fit for both models
- Reject the null
  - Therefore the hypothesized structure does not fit the data well enough

- Exploratory Factor Analysis is executed in order to gain a better understanding about the structure of the variables and how many dimensions are in a set of variables (Byrne 2013)

Exploratory Factor Analysis

EFA 1

```
. factor work_react support emp_mhi pemp_mhi share_ff a_career
(obs=14)

Factor analysis/correlation                    Number of obs    =         14
    Method: principal factors                  Retained factors =          4
    Rotation: (unrotated)                      Number of params =         15
```

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	1.88958	1.17384	0.6931	0.6931
Factor2	0.71575	0.42992	0.2625	0.9556
Factor3	0.28583	0.11452	0.1048	1.0604
Factor4	0.17131	0.24494	0.0628	1.1233
Factor5	-0.07363	0.18879	-0.0270	1.0962
Factor6	-0.26241	.	-0.0962	1.0000

LR test: independent vs. saturated: chi2(15) = 21.69 Prob>chi2 = 0.1162

Factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Factor3	Factor4	Uniqueness
work_react	0.7865	-0.4300	0.0861	0.1145	0.1759
support	0.4293	0.4034	0.1688	-0.2336	0.5698
emp_mhi	0.8988	0.0595	-0.0656	-0.1113	0.1720
pemp_mhi	0.1916	0.1762	0.3768	0.2111	0.7457
share_ff	0.4797	0.0301	-0.2863	0.1019	0.6767
a_career	0.1098	0.5768	-0.1473	0.1905	0.5973

EFA 2

```
. factor work_react support emp_mhi pemp_mhi share_ff
(obs=253)

Factor analysis/correlation                    Number of obs    =        253
    Method: principal factors                  Retained factors =          2
    Rotation: (unrotated)                      Number of params =          9
```

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	1.39226	1.26922	1.3405	1.3405
Factor2	0.12304	0.25139	0.1185	1.4589
Factor3	-0.12836	0.01820	-0.1236	1.3354
Factor4	-0.14656	0.05519	-0.1411	1.1942
Factor5	-0.20175	.	-0.1942	1.0000

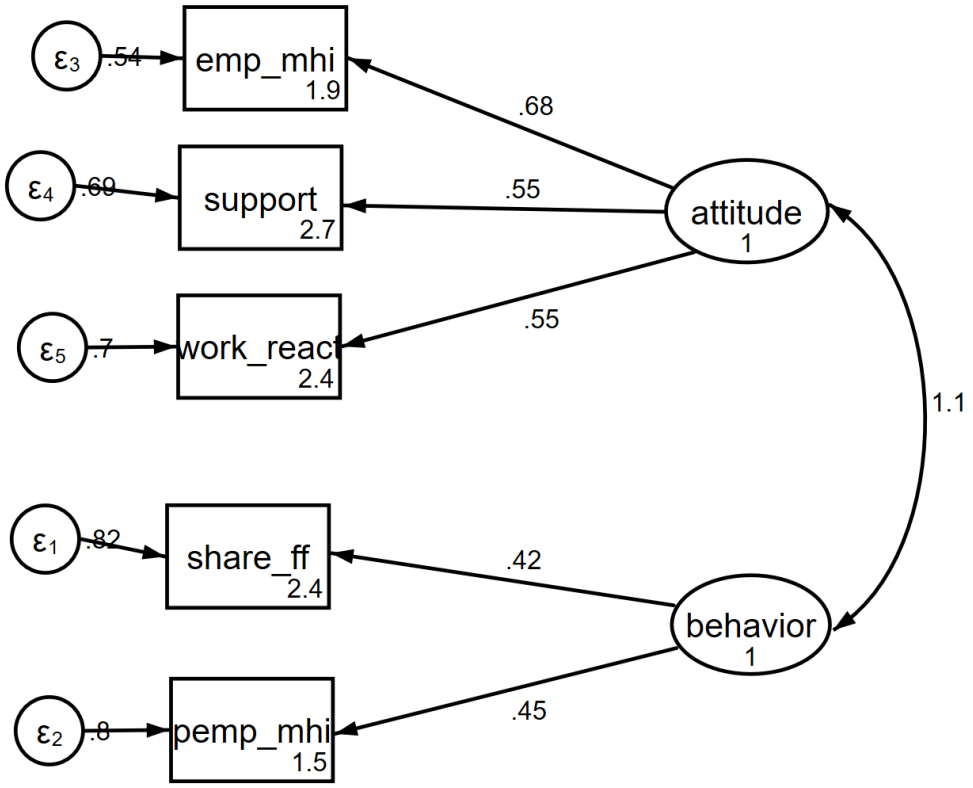
LR test: independent vs. saturated: chi2(10) = 172.60 Prob>chi2 = 0.0000

Factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Uniqueness
work_react	0.5276	0.1862	0.6870
support	0.5383	-0.1298	0.6934
emp_mhi	0.6289	-0.0576	0.6011
pemp_mhi	0.4520	-0.1804	0.7632
share_ff	0.4736	0.1888	0.7400

Exploratory Factor Analysis

Model 3



Goodness of Fit

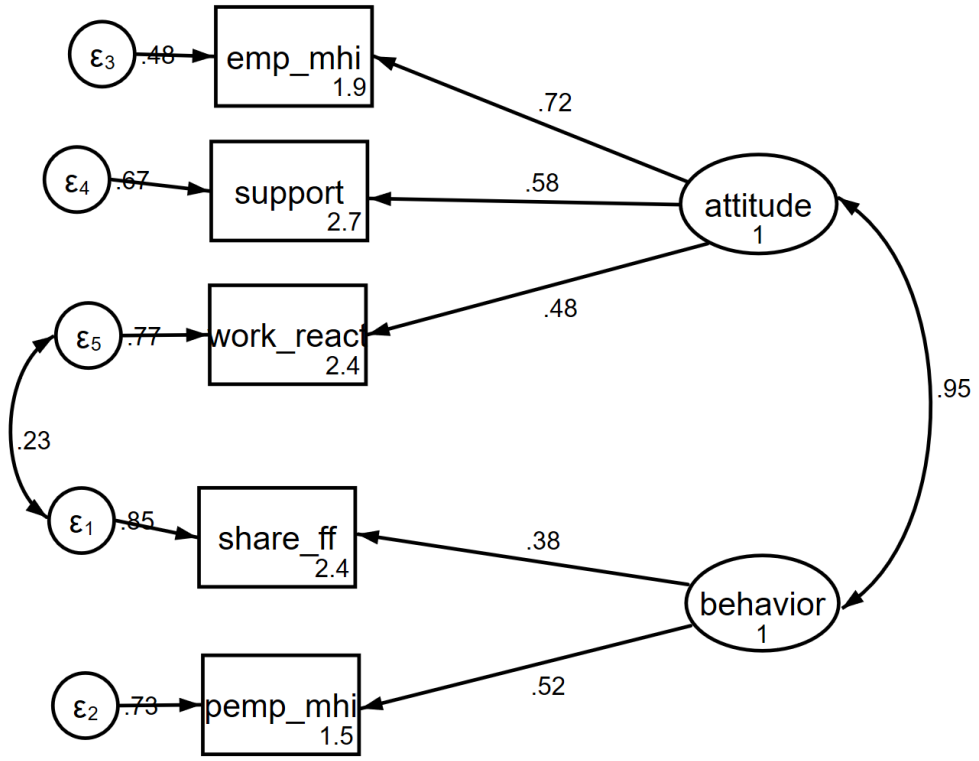
```
. estat gof, stats(all)
```

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(**4**)	**16.669**	model vs. saturated
p > chi2	**0.002**	
chi2_bs(**10**)	**219.029**	baseline vs. saturated
p > chi2	**0.000**	
Population error		
RMSEA	**0.095**	Root mean squared error of approximation
90% CI, lower bound	**0.051**	
upper bound	**0.144**	
pclose	**0.047**	Probability RMSEA <= 0.05
Information criteria		
AIC	**6850.761**	Akaike's information criterion
BIC	**6912.579**	Bayesian information criterion
Baseline comparison		
CFI	**0.939**	Comparative fit index
TLI	**0.848**	Tucker-Lewis index
Size of residuals		
CD	**0.667**	Coefficient of determination

Note: SRMR is not reported because of missing values.

Exploratory Factor Analysis

Model 4



Goodness of Fit

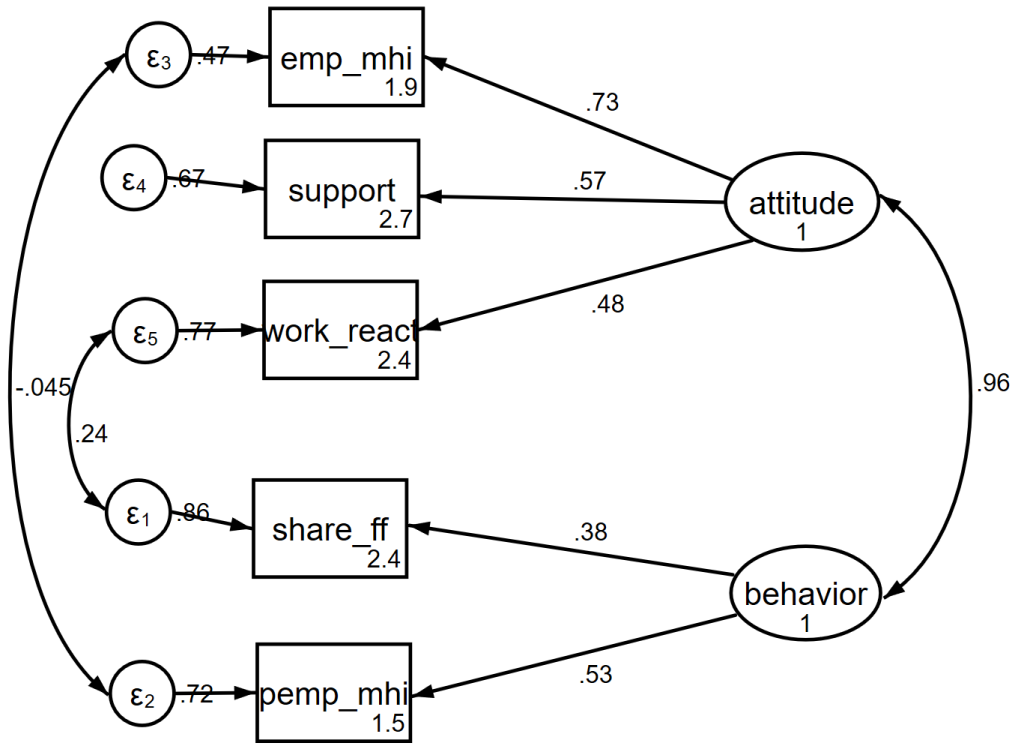
```
. estat gof, stats(all)
```

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(3)	**3.487**	model vs. saturated
p > chi2	**0.322**	
chi2_bs(10)	**219.029**	baseline vs. saturated
p > chi2	**0.000**	
Population error		
RMSEA	**0.022**	Root mean squared error of approximation
90% CI, lower bound	**0.000**	
upper bound	**0.095**	
pclose	**0.642**	Probability RMSEA <= 0.05
Information criteria		
AIC	**6839.579**	Akaike's information criterion
BIC	**6905.261**	Bayesian information criterion
Baseline comparison		
CFI	**0.998**	Comparative fit index
TLI	**0.992**	Tucker-Lewis index
Size of residuals		
CD	**0.707**	Coefficient of determination

Note: SRMR is not reported because of missing values.

Exploratory Factor Analysis

Model 5



Goodness of Fit

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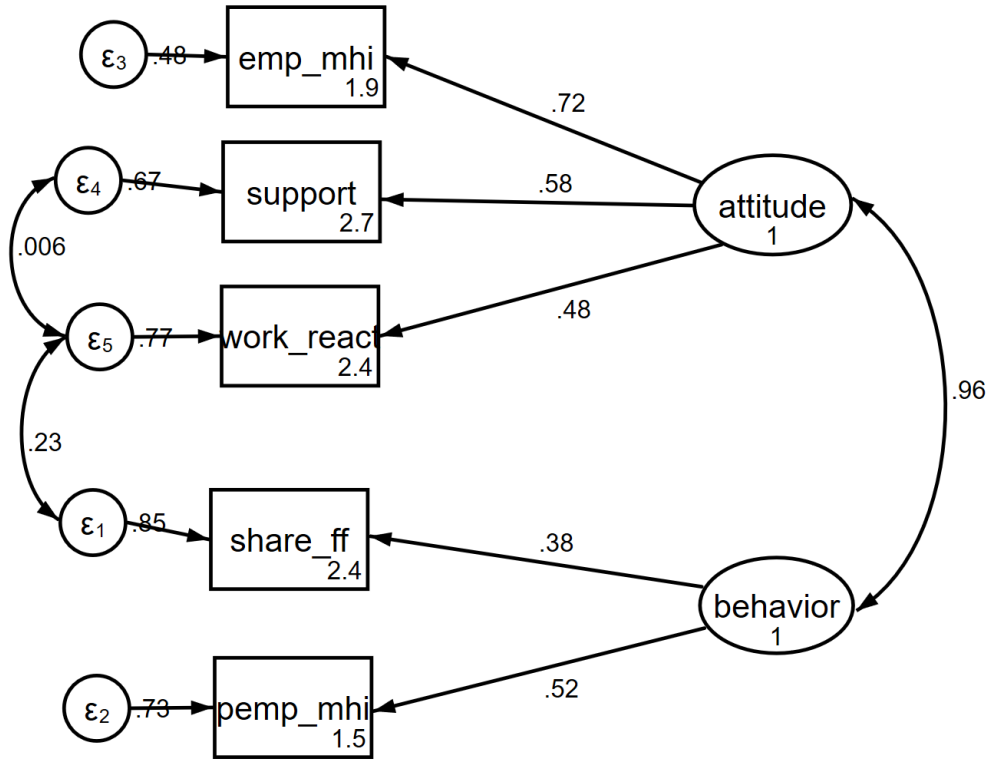
. estat gof, stats(all)
```

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(2)	**3.370**	model vs. saturated
p > chi2	**0.185**	
chi2_bs(10)	**219.029**	baseline vs. saturated
p > chi2	**0.000**	
Population error		
RMSEA	**0.044**	Root mean squared error of approximation
90% CI, lower bound	**0.000**	
upper bound	**0.124**	
pclose	**0.435**	Probability RMSEA <= 0.05
Information criteria		
AIC	**6841.462**	Akaike's information criterion
BIC	**6911.007**	Bayesian information criterion
Baseline comparison		
CFI	**0.993**	Comparative fit index
TLI	**0.967**	Tucker-Lewis index
Size of residuals		
CD	**0.718**	Coefficient of determination

Note: SRMR is not reported because of missing values.

Exploratory Factor Analysis

Model 6



Goodness of Fit

```
. estat gof, stats(all)
```

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(2)	**3.480**	model vs. saturated
p > chi2	**0.175**	
chi2_bs(10)	**219.029**	baseline vs. saturated
p > chi2	**0.000**	
Population error		
RMSEA	**0.046**	Root mean squared error of approximation
90% CI, lower bound	**0.000**	
upper bound	**0.125**	
pclose	**0.422**	Probability RMSEA <= 0.05
Information criteria		
AIC	**6841.573**	Akaike's information criterion
BIC	**6911.118**	Bayesian information criterion
Baseline comparison		
CFI	**0.993**	Comparative fit index
TLI	**0.965**	Tucker-Lewis index
Size of residuals		
CD	**0.707**	Coefficient of determination

Note: SRMR is not reported because of missing values.

Conclusion

- Confirmatory Factor Analysis demonstrates that the fourth model is better based on a lower AIC and BIC, a higher CFI and TLI
- The RMSEA indicates that there is a very good fit for the fourth model

- Model selection: models do not significantly differ and therefore the fourth model is selected since it is less complicated in comparison (parsimonious) while still demonstrating a very good fit

References

Baldwin, Marjorie L., and Steven C. Marcus. 2006. “Perceived and measured stigma among workers with serious mental illness.” *Psychiatric Services* 57(3): 388–392. doi: 10.1176/appi.ps.57.3.388

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Joyce, Sadhbh, Matthew Modini, Helen Christensen, Arnstein Mykletun, Richard Bryant, Philip B. Mitchell, and Samuel B. Harvey. 2016. “Workplace interventions for common mental disorders: a systematic meta-review.” *Psychological medicine* 46(4): 683–697. doi: 10.1017/S0033291715002408

Krupa, Terry, Bonnie Kirsh, Lynn Cockburn, and Rebecca Gewurtz. 2009. “Understanding the stigma of mental illness in employment.” *Work* 33(4): 413–425. doi: 10.3233/WOR-2009-0890