

Comprehensively measuring patients' subjective thoughts, feelings and experiences of living with medicines: Living with Medicines Questionnaire (LMQ)

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$$\text{Value} = \frac{\text{Outcomes}}{\text{Cost}}$$



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The outcome that matters is the one that matters to a patient



Examples of Patient Reported Outcome Measures (PROMs)

Generic	Disease/condition specific	Pharmacy services specific
Quality of Life (SF-36)	Parkinson's disease quality of life (PDQ-39)	Patient Satisfaction With Pharmaceutical Care
Quality of Life Scale (QOLS)	The Caregiver Quality of Life Index-Cancer (CQOLC) scale	Perceived value of quality measures in pharmacy

**Target group: Patients using multiple medicines
to treat multiple chronic health conditions**

- › Probes concepts (domains) about patients' thoughts, feelings and experiences of medication therapy
- › Items generated using qualitative techniques, informed by theory
- › Comprehensive yet parsimonious
- › Valid, reliable and works in a variety of settings

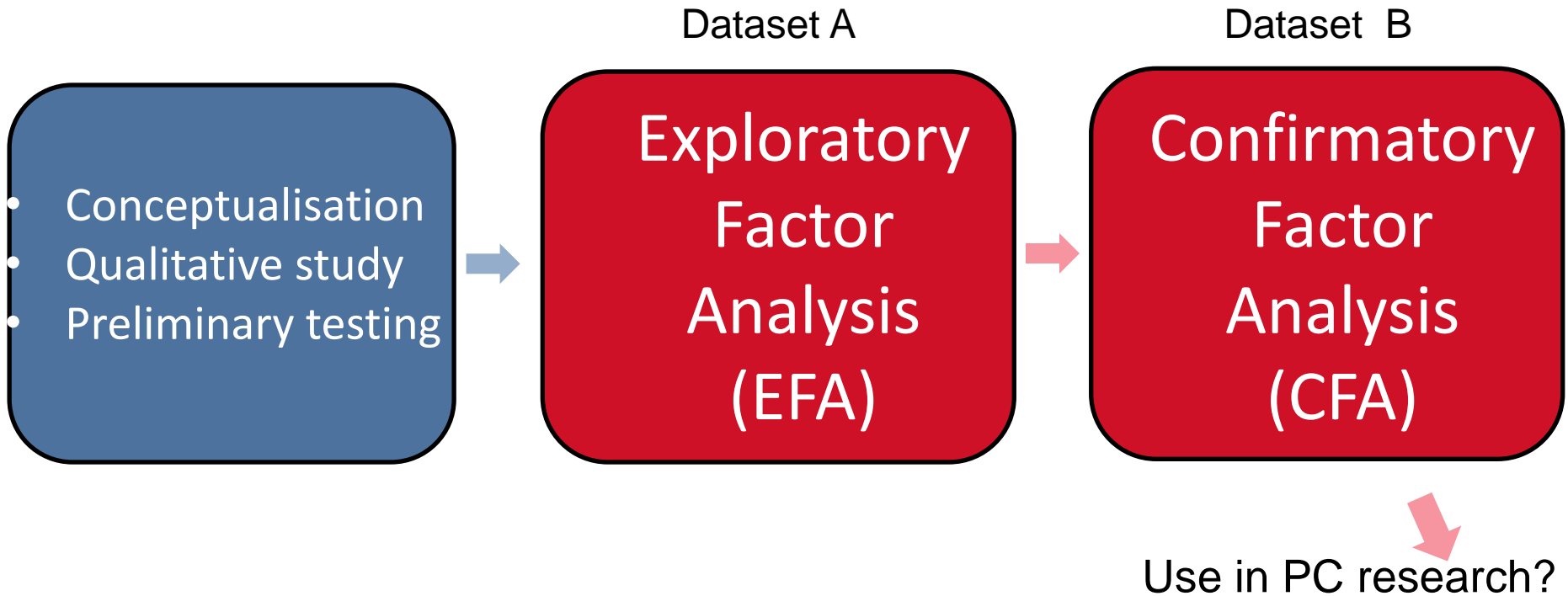
- › Quantifies patient's thoughts, feelings and experiences of using long term medicines.
- › Generated from 21 qualitative interviews²
- › 60-items, 8 proposed domains
- › Preliminary testing

	Strongly agree	Agree	Neutral opinion	Disagree	Strongly disagree
1. The instructions on my medicines are easy to follow.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I find getting my prescriptions from the doctor difficult .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

¹Krska et al., (2013) *International Journal of Clinical Pharmacy*; 36

²Krska et al., (2013) *International Journal of Clinical Pharmacy*; 35

Sequence of LMQ development



Objectives of the present study

Towards a comprehensive yet parsimonious measurement scale for LMQ

1. Elucidate the underlying factor structure of LMQ using Exploratory Factor Analysis (EFA)
2. Confirm (and modify if needed) the hypothesised factor structure with Confirmatory Factor Analysis (CFA) using data from a separate sample
3. Report scale psychometrics - convergent and discriminant validity
4. Determine whether it is valid to compare factor scores across settings/cultures

Objective 1. Method: EFA

- › 60-item questionnaire, paper, and internet survey
- › **United Kingdom**
- › Patients from community pharmacies, general public
- › Contacted via health websites, social media
- › Using 4 or more medicines
- › n=267
- › SPSS Principal Components Analysis (PCA). Orthogonal rotation was used and the final structure checked with oblique.

Objective 1. Results of EFA

- › Sufficient sample size.
- › Observation of Eigenvalues and the Scree plot suggested a 10 factor model.
- › Following this, 12 items were excluded because:
 - Low communalities
 - Low factor loadings
 - High cross loadings

Summary of Objective 1:

- › Factor structure elucidated, 10 (not 8) domains, 48 items, explaining 61.7% of the variance

Objective 1. Results of EFA

10 Domains

1. Communicating with doctor
2. Communication with pharmacist
3. Satisfied that medicines are effective
4. Acceptance of taking medicines
5. Autonomy to vary the regimen
6. Interference to life caused by medicines
7. Practical difficulties
8. Access difficulties
9. Concerns about taking medicines
10. Concerns about continuity

10 Domains

1. Communicating with doctor
2. Communication with pharmacist
3. Satisfied that medicines are effective
4. Acceptance of taking medicines
5. Autonomy to vary the regimen
6. Interference to life caused by medicines
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8. Access difficulties
9. Concerns about taking medicines
10. Concerns about continuity

Items



*The doctor listens to my
opinions about medicines*

10 Domains

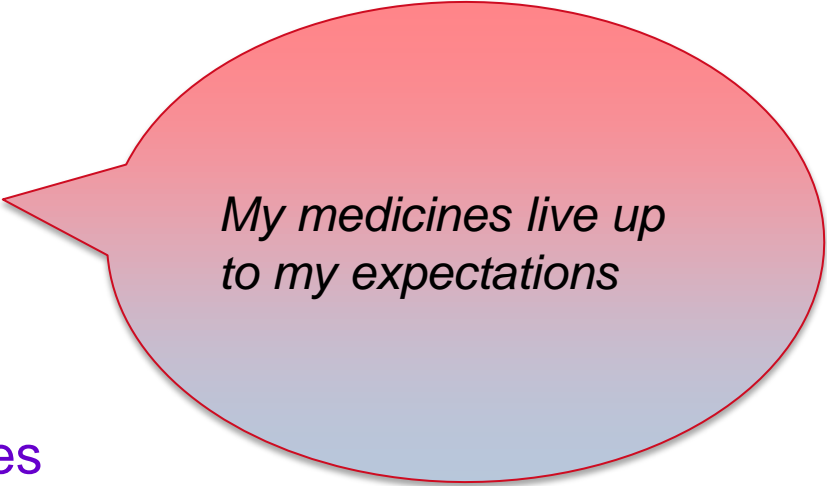
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9. Concerns about taking medicines
10. Concerns about continuity



I understand what the pharmacist tells me

Domains

1. Communicating with doctor
2. Communication with pharmacist
3. Satisfied that medicines are effective
4. Acceptance of taking medicines
5. Autonomy to vary the regimen
6. Interference to life caused by medicines
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9. Concerns about taking medicines
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My medicines live up to my expectations

Domains

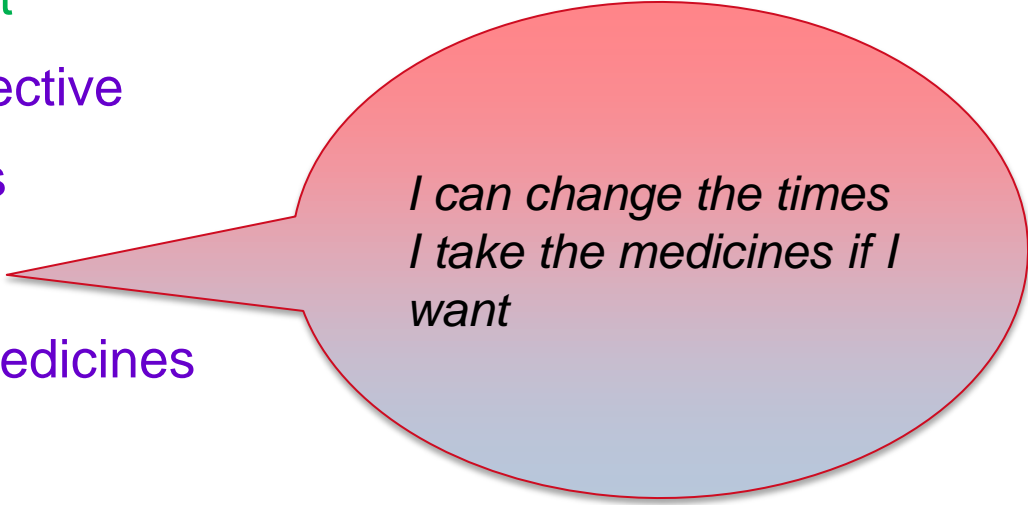
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5. Autonomy to vary the regimen
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8. Access difficulties
9. Concerns about taking medicines
10. Concerns about continuity



*Taking medicines is
routine for me*

Domains

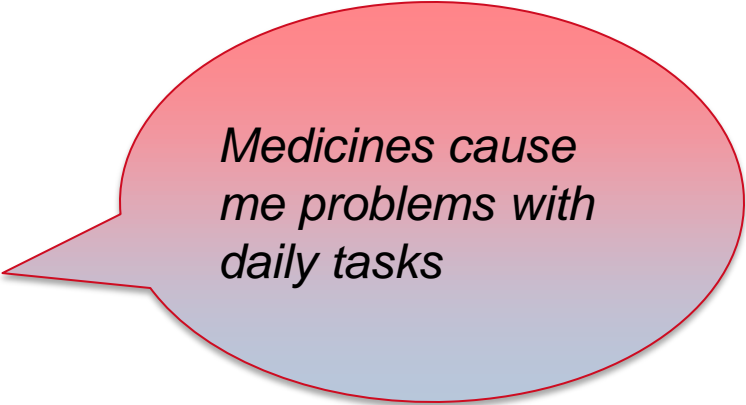
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8. Access difficulties
9. Concerns about taking medicines
10. Concerns about continuity



*I can change the times
I take the medicines if I
want*

Domains

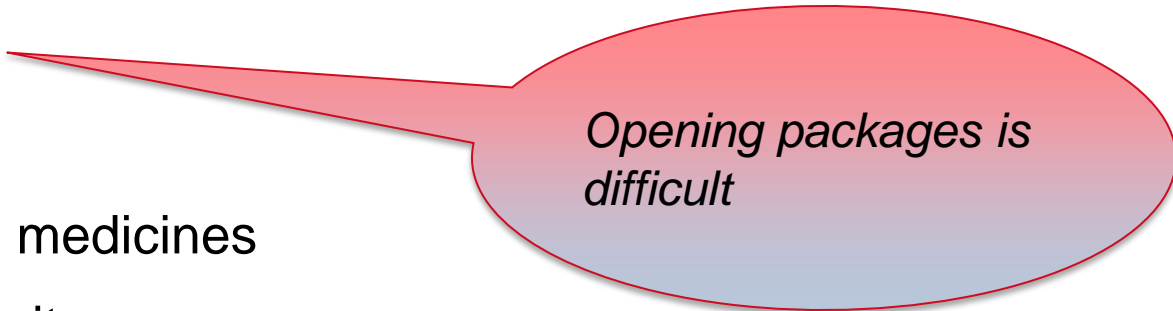
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*Medicines cause
me problems with
daily tasks*

Domains

1. Communicating with doctor
2. Communication with pharmacist
3. Satisfied that medicines are effective
4. Acceptance of taking medicines
5. Autonomy to vary the regimen
6. Interference to life caused by medicines
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Opening packages is difficult

Domains

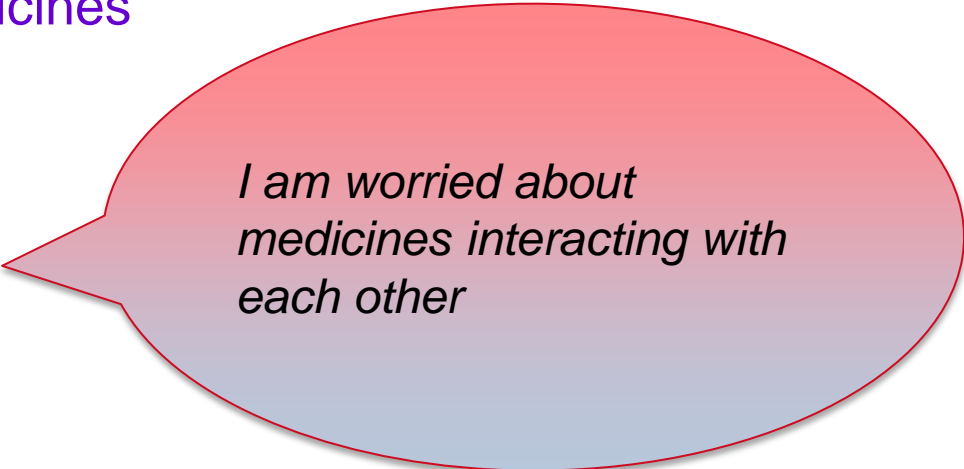
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Getting prescriptions is difficult

Domains

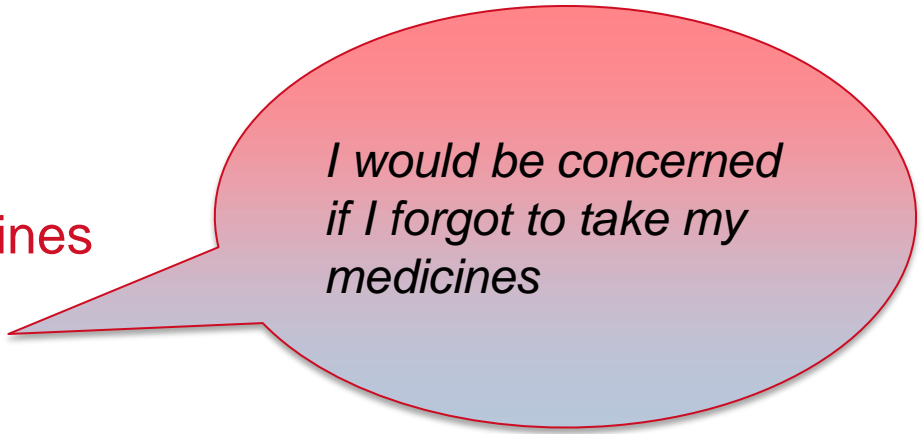
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9. Concerns about taking medicines
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I am worried about medicines interacting with each other

Domains

1. Communicating with doctor
2. Communication with pharmacist
3. Satisfied that medicines are effective
4. Acceptance of taking medicines
5. Autonomy to vary the regimen
6. Interference to life caused by medicines
7. Practical difficulties
8. Access difficulties
9. Concerns about taking medicines
10. Concerns about continuity



*I would be concerned
if I forgot to take my
medicines*

Objective 2. Confirmatory Factor Analysis

- › **Australia**
- › 46-item questionnaire (12 items deleted during EFA and 2 deleted afterwards for conceptual reasons)
- › Internet survey using a panel of subjects from “The Digital Edge”
- › Inclusion criteria: using 5 or more medicines
- › $n=528$ (minimum: 500^a)

^aMacCallum , et al., (1999) *Psychological Methods*

Objective 2. Confirmatory factor analysis

Methods

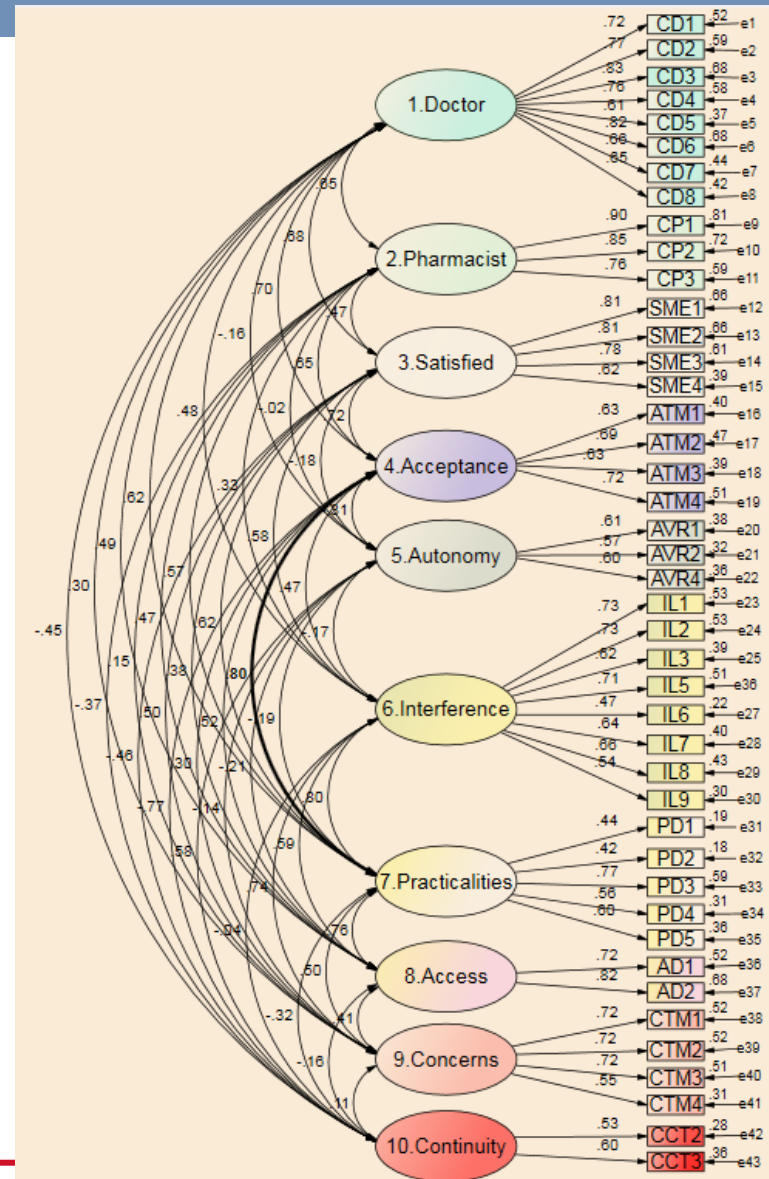
- › Maximum Likelihood Estimation (MLE) with robust error estimation with (AMOS and EQS v6.2) was used to construct the hypothesised 10 factor measurement model.
- › Then inspected:
 - Error residuals,
 - indices of fit, and
 - modification indices
- › with the goal of improving measurement model.

Step 1. Test model

	Satorra-Bentler scaled Chi ² /df	CFI	TLI	RMSEA
AIM ^{1,2}	< 2	> 0.9	> 0.9	< 0.050
1. Test model	2.44	0.85	0.83	0.053

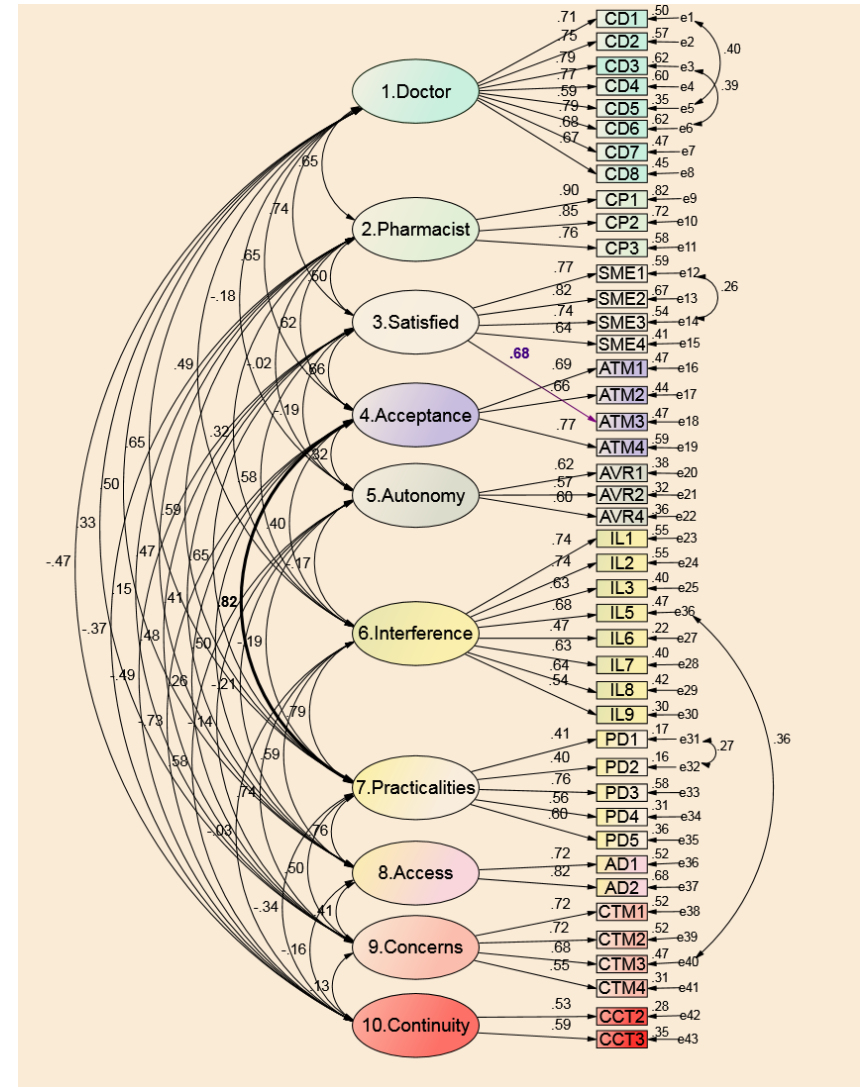
¹Hair, et al., (2006) *Multivariate data analysis*

²Chung and Rensvold (2002). *Structural Equation Modelling*



Step 2. Improve model fit

	Satorra-Bentler scaled χ^2/df	CFI	TLI	RMSEA
AIM	< 2	> 0.9	> 0.9	< 0.050
1. Test model	2.44	0.85	0.83	0.053
2. Three items deleted	2.27	0.88	0.87	0.050
3. Change loading ATM3	2.21	0.89	0.87	0.048
4. Allow correlated error terms	1.97	0.91	0.90	0.042



Objective 3a. Convergent Validity

Domain	Number of items	Lowest regression weight	Composite reliability (CR)	Average variance extracted (AVE)
Communicating with doctor	8	.59	0.90	52%
Communication with pharmacist	3	.76	0.88	71%
Satisfied that medicines are effective	5	.64	0.85	54%
Acceptance of taking medicines	3	.67	0.75	50%
Autonomy to vary the regimen	3	.57	0.62	35%
Interference to life caused by medicines	8	.47	0.85	41%
Practical difficulties	5	.40	0.69	32%
Access difficulties	2	.72	0.75	60%
Concerns about taking medicines	4	.55	0.77	45%
Concerns about continuity	2	.53	0.48	32%
Ideally ^{1,2}	≥3	most ≥0.7	≥0.7	≥50%

¹Hair, et al., (2006) *Multivariate data analysis*

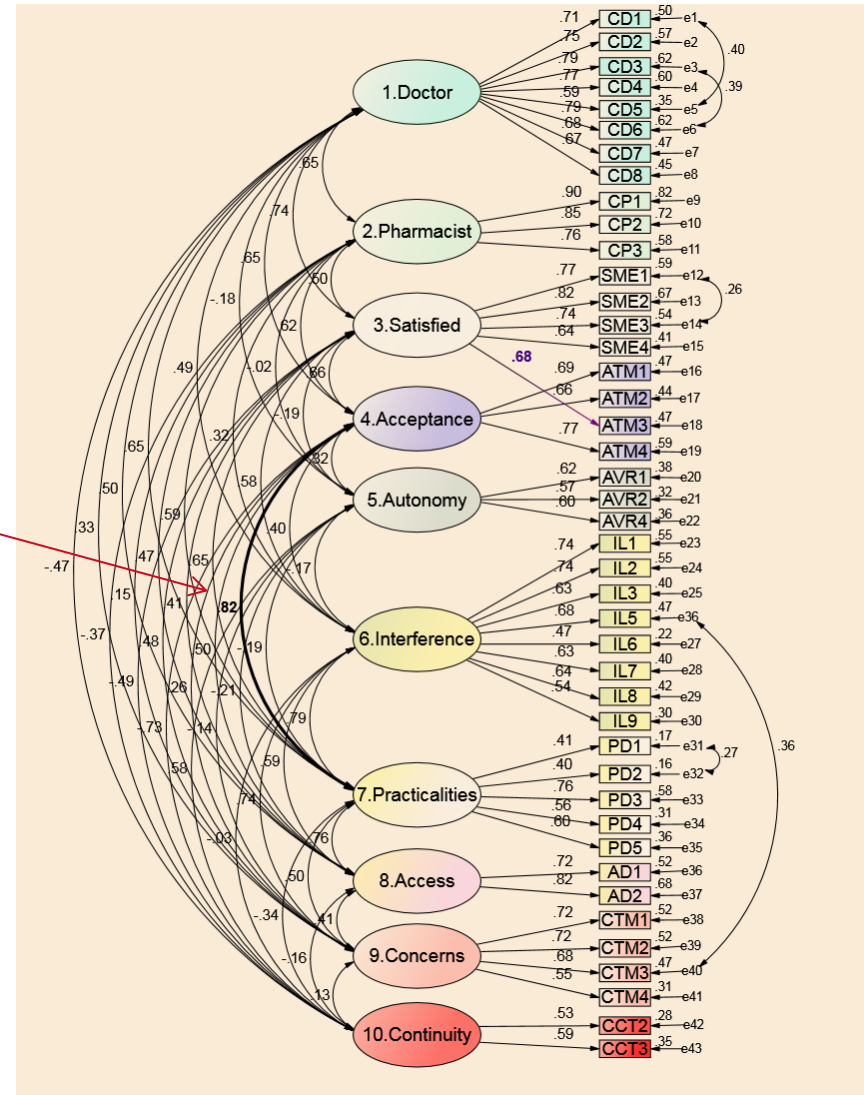
²Fornell and Larcker (1981) *Journal of marketing research*

Objective 3b. Discriminant Validity

Discriminant validity is suggested when the correlation between pairs of factors is not excessively high (>0.85).¹

The highest was 0.82.

However, more stringent tests suggest potential problems²



¹Hair, et al., (2006) *Multivariate data analysis*

²Fornell and Larcker (1981) *Journal of marketing research*

Objective 4. Factorial Invariance¹

1. Configural invariance between UK and Australian data was observed (RMSEA = 0.039).

Respondents in both groups are completing the questionnaire with the same conceptual framework.

2. Metric (weak) invariance was also observed (RMSEA = 0.040, $\Delta\text{CFI} = - 0.008$).

This is the minimum standard to be achieved if factor scores are to be compared.

3. Strong invariance was not observed (RMSEA = 0.044, $\Delta\text{CFI} = - 0.018$).

This suggests that the factor scores are centered around different mean values

¹Chung and Rensvold (2002). *Structural Equation Modelling*

LMQ – 43, generated with rigorous methodology

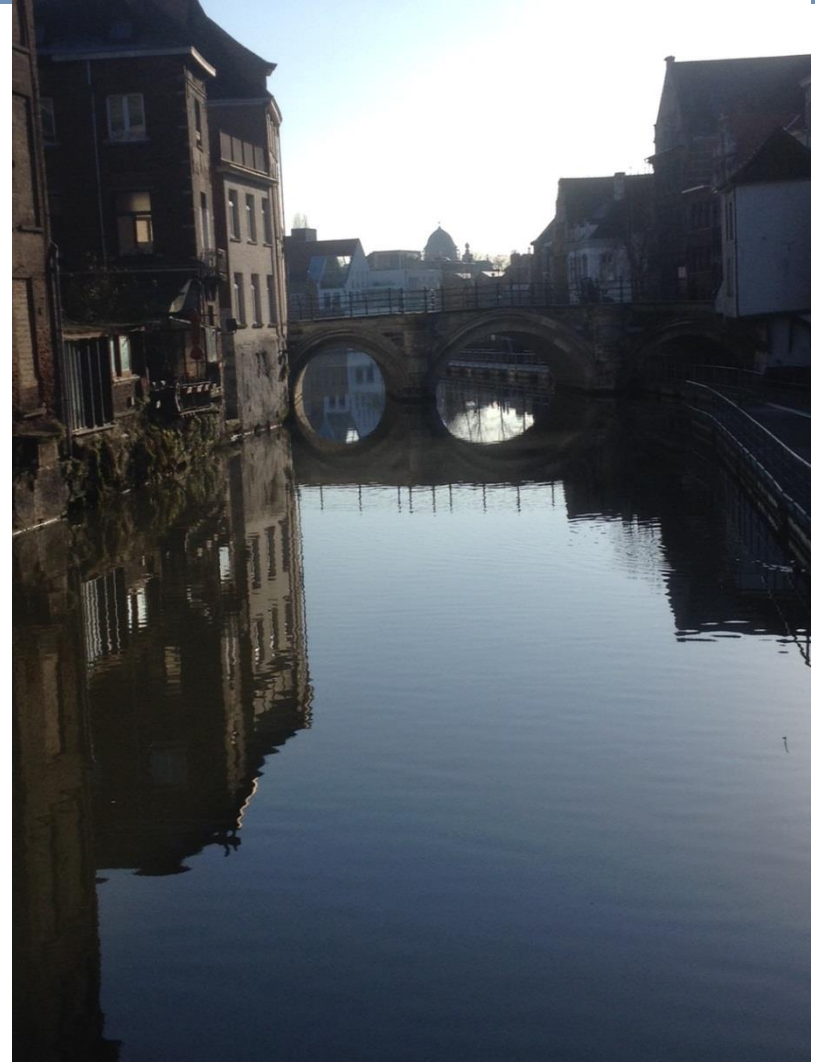
- › EFA suggests LMQ has 10 domains
- › CFA suggests that LMQ - 43 items gives a reasonable fit to the data
- › Majority of subscales have reasonable psychometric properties
- › It appears valid to compare factor scores between groups
- › Comprehensive yet parsimonious
- › Includes domains which may be influenced by pharmaceutical care interventions
- › **Future work**
- › Sub-scales with poorer psychometric properties need additional or refined items
- › Possibly, some items deleted belong to other domains which are not represented
- › CFA and Factorial Invariance should be repeated with datasets from different settings
- › Translation to other languages



Kent



Sydney



Kent



Sydney

Mechelen and beyond?

- › **Co-authors: Gladys Bulanadi,¹ Timothy F Chen,¹**
- › **Barbra Katusiime,² Sarah Corlett,² Janet Krska.²**

- › **My fiancée, Simone and family**

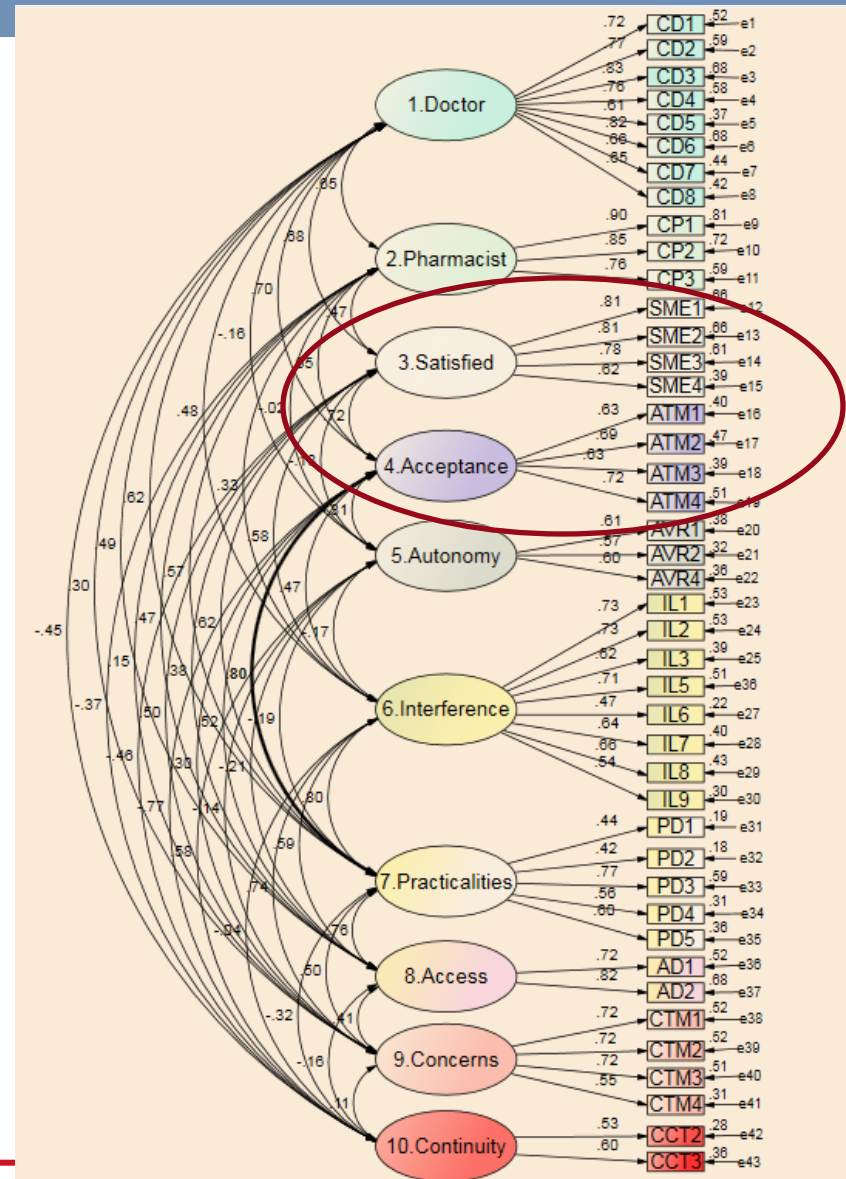
- › **Ramesh Walpola¹**

› ¹ Faculty of Pharmacy, University of Sydney, Sydney, NSW, Australia.

› ² Medway School of Pharmacy, The Universities of Kent and Greenwich, Chatham Maritime, UK

Results: Confirmatory Factor Analysis (CFA)

	Satorra-Bentler scaled χ^2/df	CFI	TLI	RMSEA
AIM	< 2	> 0.9	> 0.9	< 0.050
Model 1	2.44	0.85	0.83	0.053

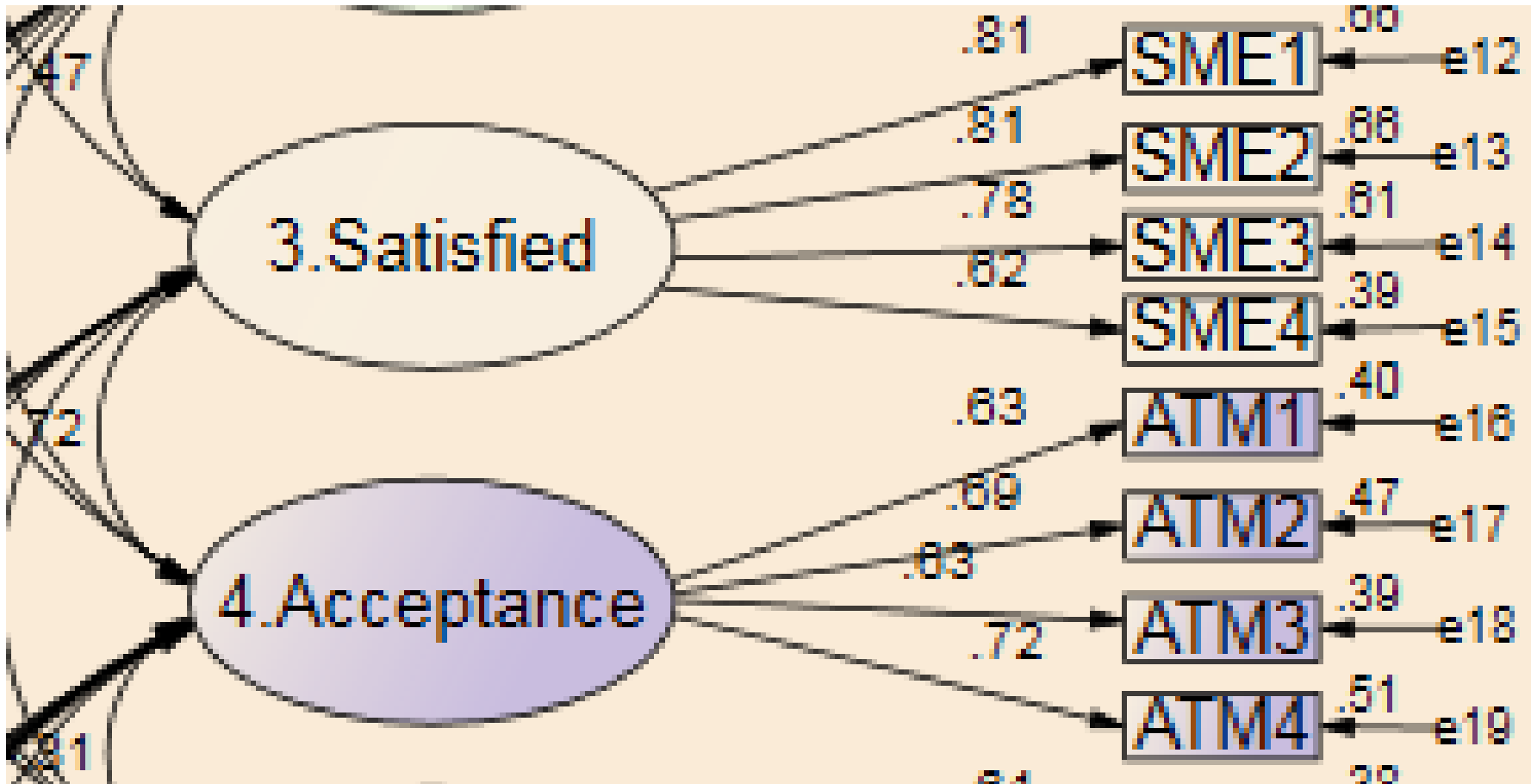


Confirmatory Factor Analysis (CFA)

“latent” constructs

items

errors

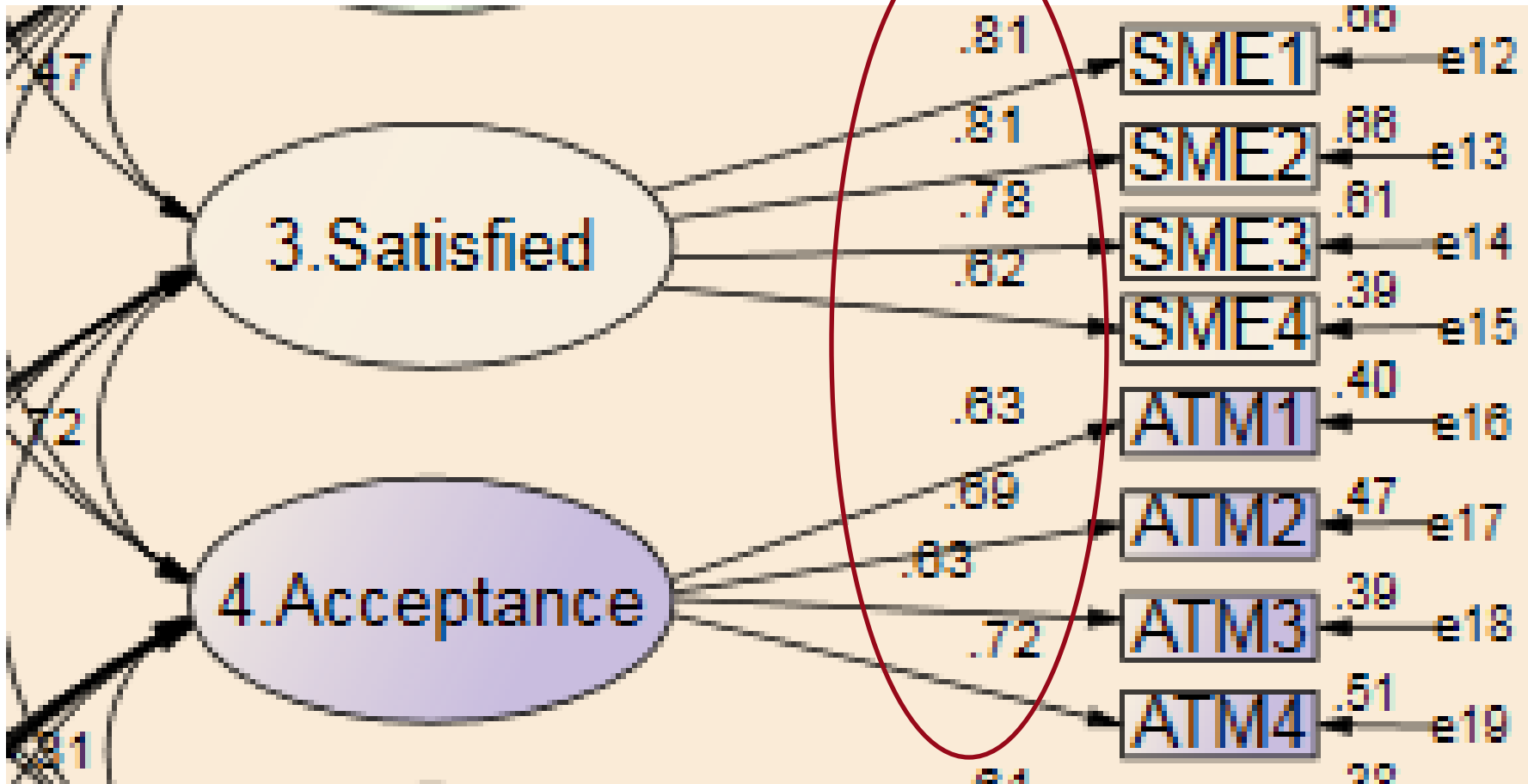


Confirmatory Factor Analysis (CFA)

“latent” constructs

items

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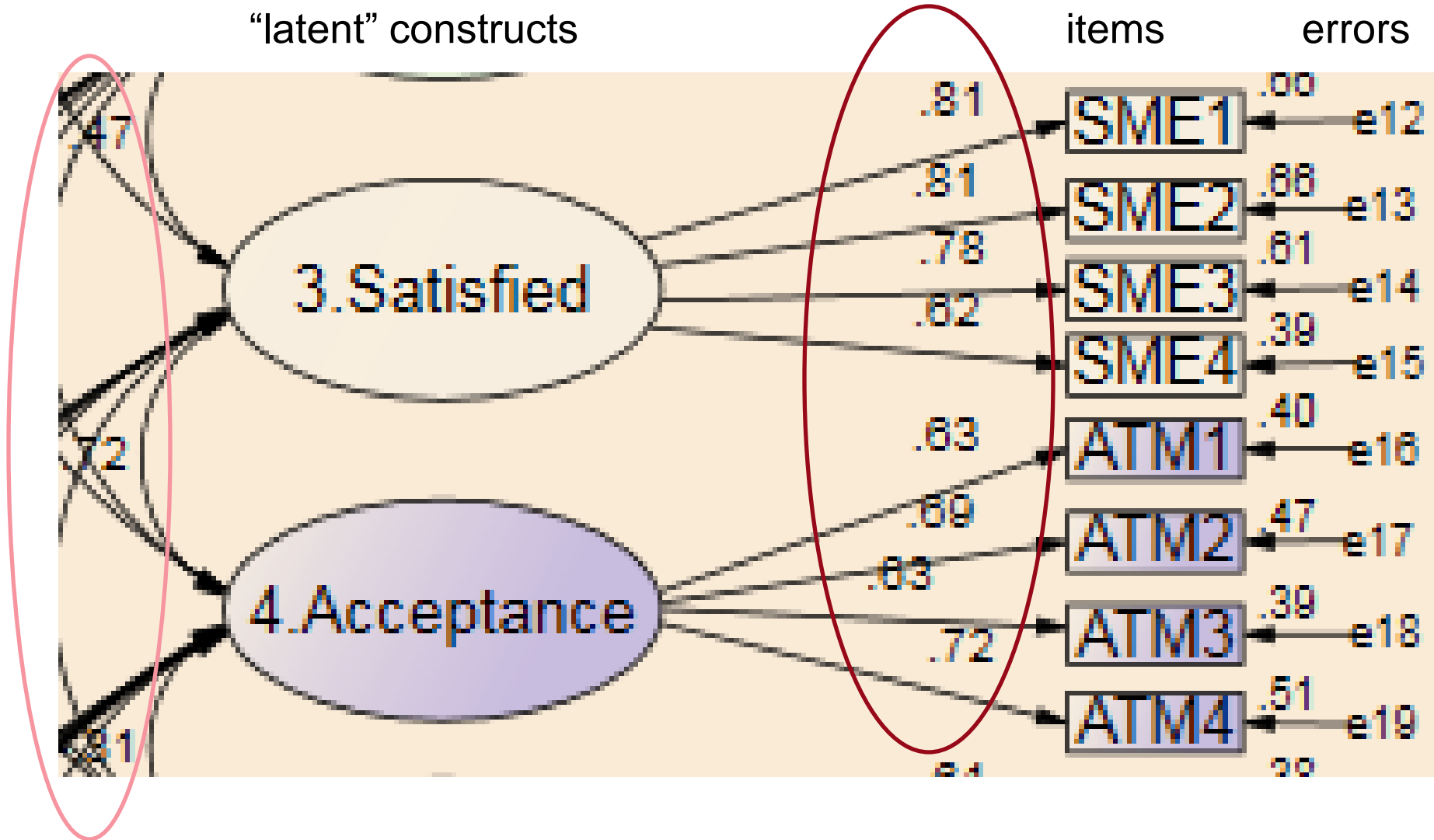


Confirmatory Factor Analysis (CFA)

“latent” constructs

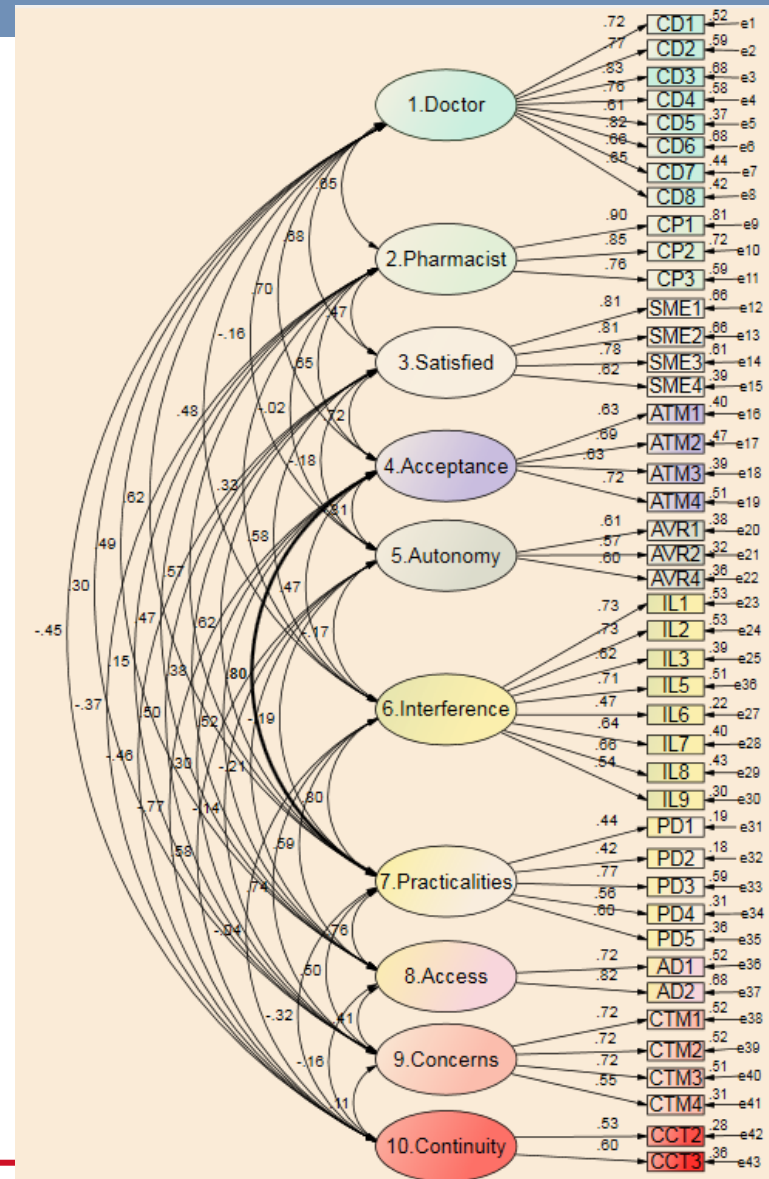
items

errors



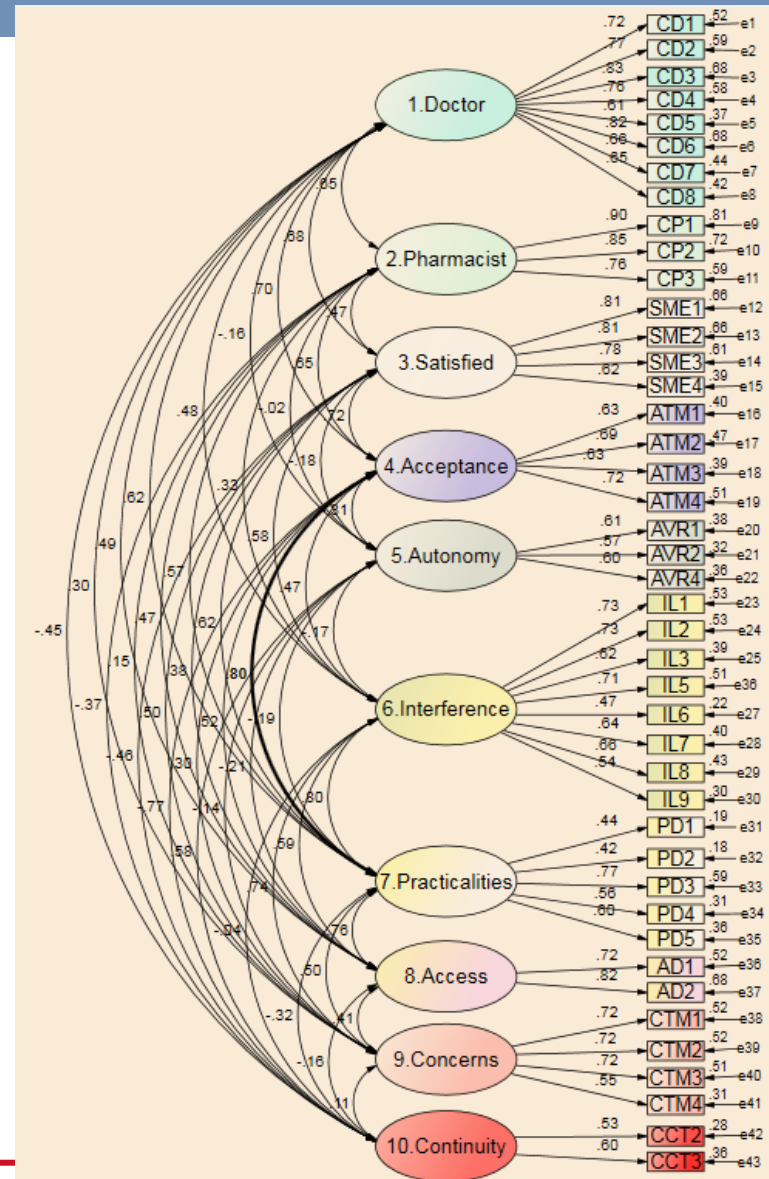
	Satorra-Bentler scaled χ^2/df	CFI	TLI	RMSEA
AIM	< 2	> 0.9	> 0.9	< 0.050
Model 1	2.44	0.85	0.83	0.053

Step 1. Look for high correlated residual errors. AVR3, CCT1, IL4 (>.3)



	Satorra-Bentler scaled χ^2/df	CFI	TLI	RMSEA
AIM	< 2	> 0.9	> 0.9	< 0.050
Model 1	2.44	0.85	0.83	0.053
Three items deleted	2.26	0.88	0.87	0.049

High correlated residual errors
AVR3, CCT1, IL4 (>.3)

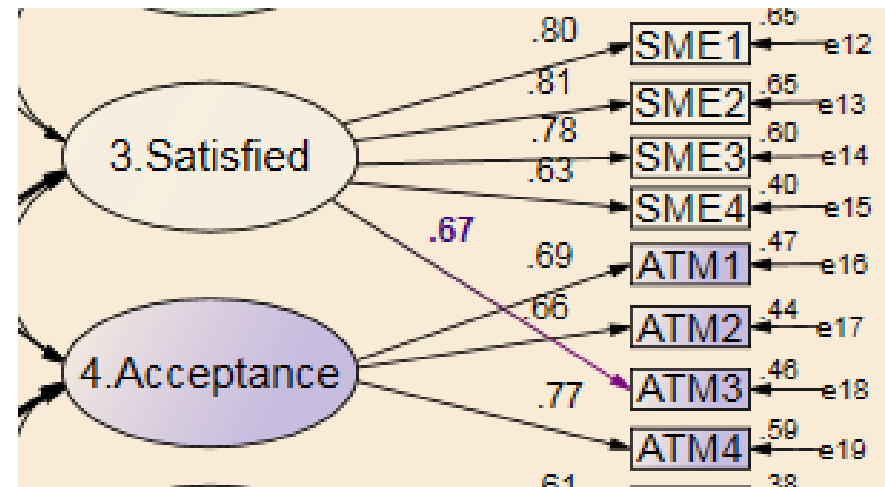
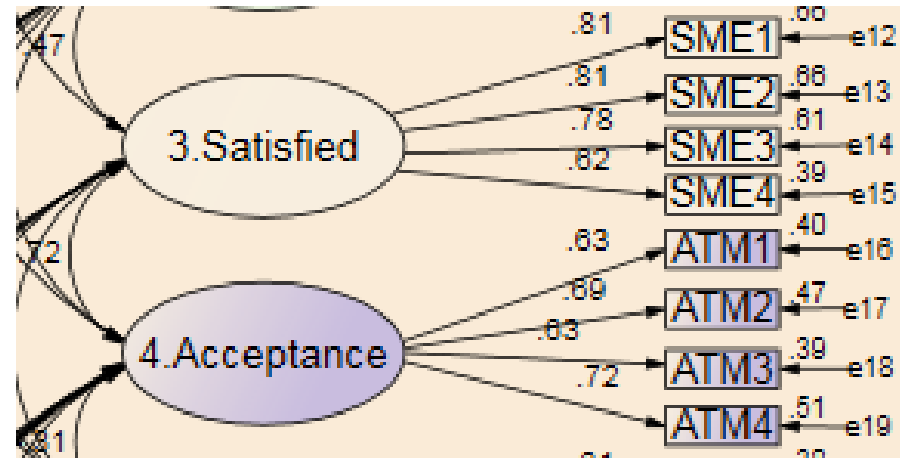


Confirmatory Factor Analysis (CFA)

Next step

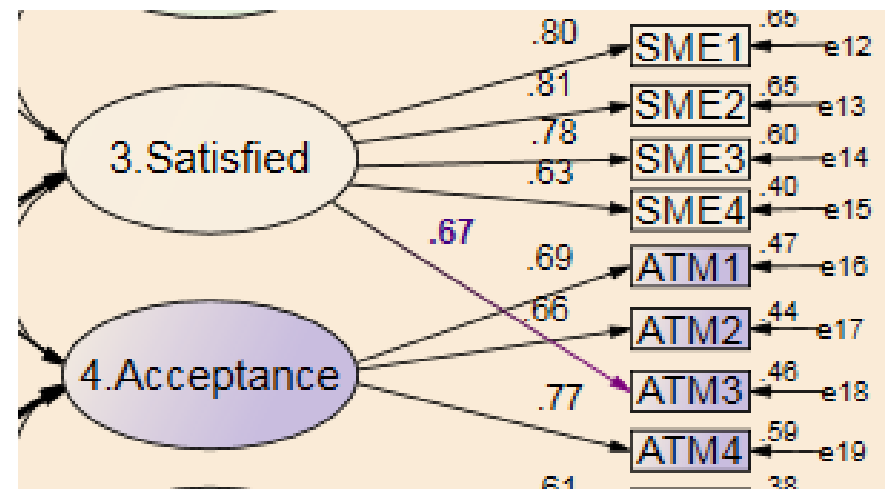
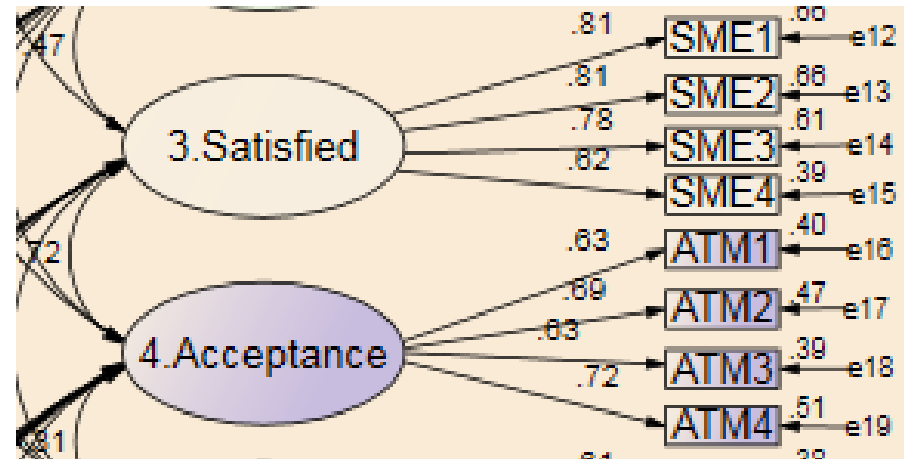
Inspection of **Modification Indices**.

Suggests:



Confirmatory Factor Analysis (CFA)

	Satorra-Bentler scaled χ^2/df	CFI	TLI	RMSEA
AIM	< 2	> 0.9	> 0.9	< 0.050
Model 1	2.44	0.85	0.83	0.053
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Change loading ATM3	2.21	0.89	0.87	0.048



Next step

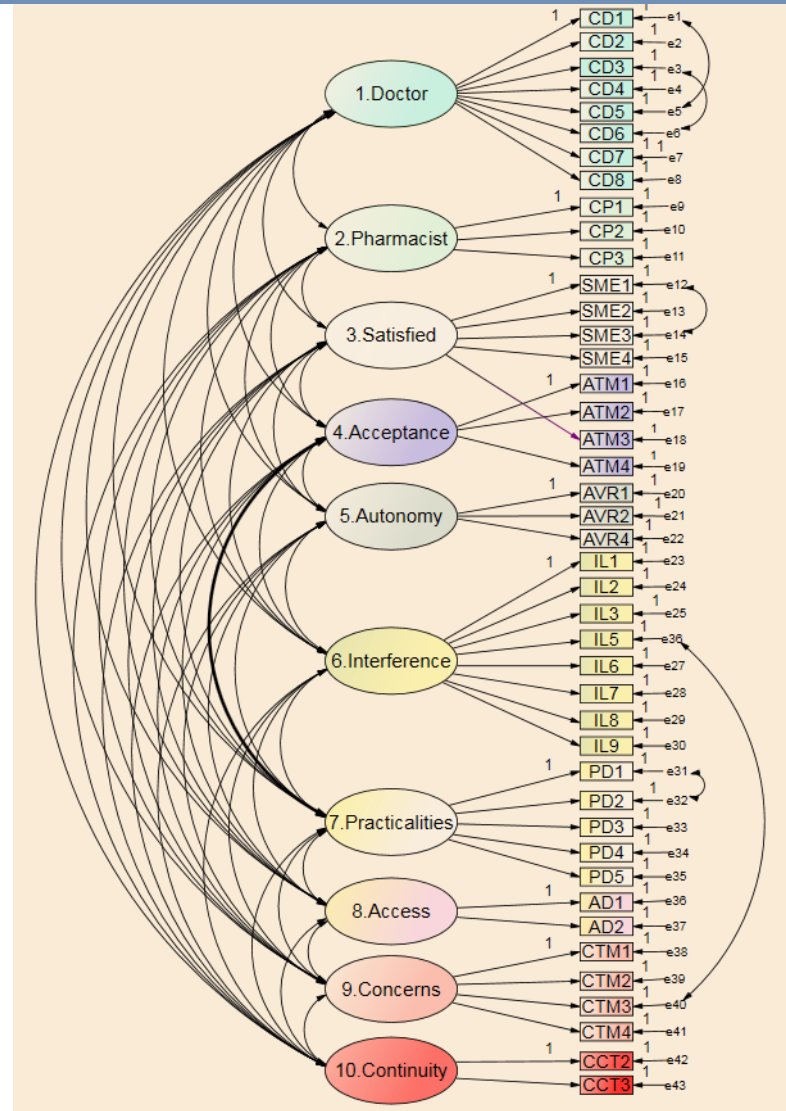
Use modification indices to advise on correlated error terms

Only allow if theoretically grounded (common sense)

eg:

IL5. Worry about taking medicines at same time

CTM3. Worry medicines interact with each other



Satorra-Bentler scaled χ^2/df

CFI

TLI

RMSEA

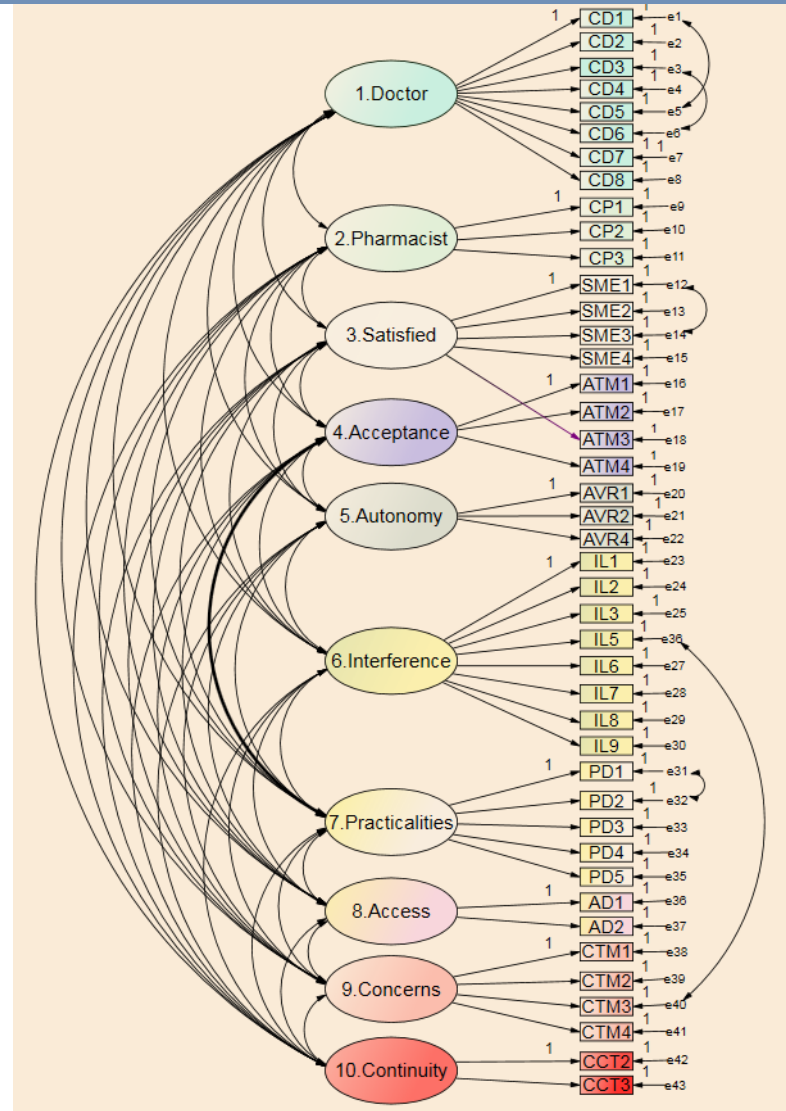
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Model 1 2.44 0.85 0.83 0.053

Three items deleted 2.27 0.88 0.87 0.050

Change loading ATM3 2.21 0.89 0.87 0.048

Correlated error terms 1.97 0.91 0.90 0.042



› Construct validity

- The extent to which the intended instruments measures the concept it is supposed to measure

› Convergent validity

- The notion that two or more measures of the same thing should covary highly if they are valid measures of the concept

› Discriminant validity

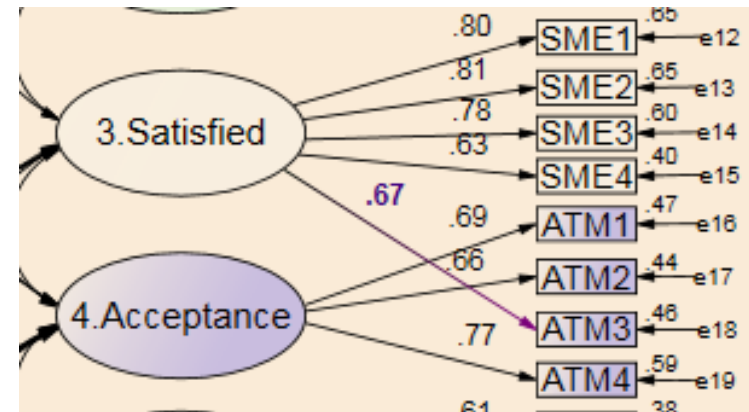
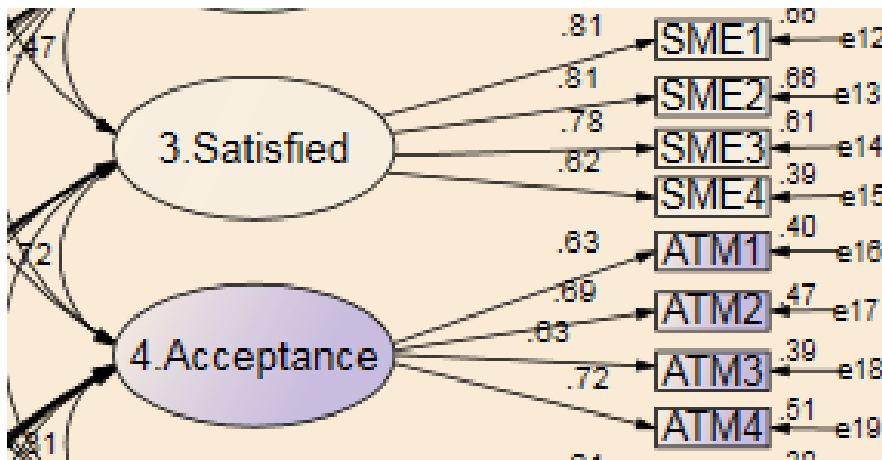
- The notion that if two or more concepts are unique, they should not correlate too highly
-

- › Lowest level: configural – items in an instrument exhibit the same configuration of loadings in each of the different countries. The analysis should confirm that the same items measure each construct in all countries. All item loadings should be substantial and significant, and correlations should be less than 1.
- › Second level: metric/measurement – assesses a necessary condition for equivalence meaning.
- › Third level: scalar – justifies comparing the means of the underlying constructs across countries. Signifies that cross-country differences in the means of the observed items result from differences in the means of their corresponding constructs. TO assess scale invariance, one constrains the intercepts of the underlying items to be equal across countries, and tests model fit to the data.

Analysis: Stage 1 Factor Structure

Descriptive statistics and Exploratory Factor Analysis (EFA)

- › Use SPSS program to report descriptive statistics
- › Use SPSS to do EFA which allows us to the elucidate underlying factor structure
- › Remove items with low communalities
- › Remove cross-loading items
- › Potentially rename domains



Satisfied that medicines are effective (SME)

SME1. Satisfied with effectiveness of medicines

SME2. Medicines are working

SME3. Medicines live up to expectations

SME4. Medicines prevent condition getting worse

Acceptance of using medicines (ATM)

ATM1. Taking medicines is routine for me

ATM2. Accept I have to take medicines long term

ATM3. My medicines allow me to live as I want to

ATM4. Comfortable with the time times I take them