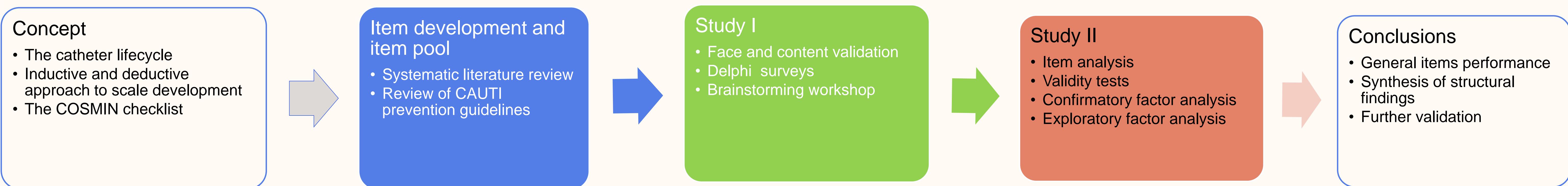


Development of a scale to measure catheter-associated urinary tract infection prevention knowledge

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Background

CAUTI are among the most common HAIs that prolongs hospital stays and increases patient care costs, morbidity, mortality and antibiotic use. An important intervention to decrease the risk of CAUTI is improving healthcare professionals' knowledge. Appropriate knowledge measurement is essential to evaluate the impact of such interventions.

To evaluate CAUTI prevention knowledge, rigorous development and evaluation processes are necessary to ensure the measurement scales meet psychometric standards. Essential to the process is defining the content area based on a conceptual model.

We developed a measurement tool to evaluate CAUTI prevention knowledge of healthcare professionals, through a series of projects using deductive and inductive approaches.

Item development and item pool

- Systematic literature review guided by the catheter lifecycle model
 - The COSMIN checklist as a quality measure
- Findings suggested an additional domain – “background knowledge of CAUTI”
- CAUTI prevention literature reviewed
- 64 items initially developed.

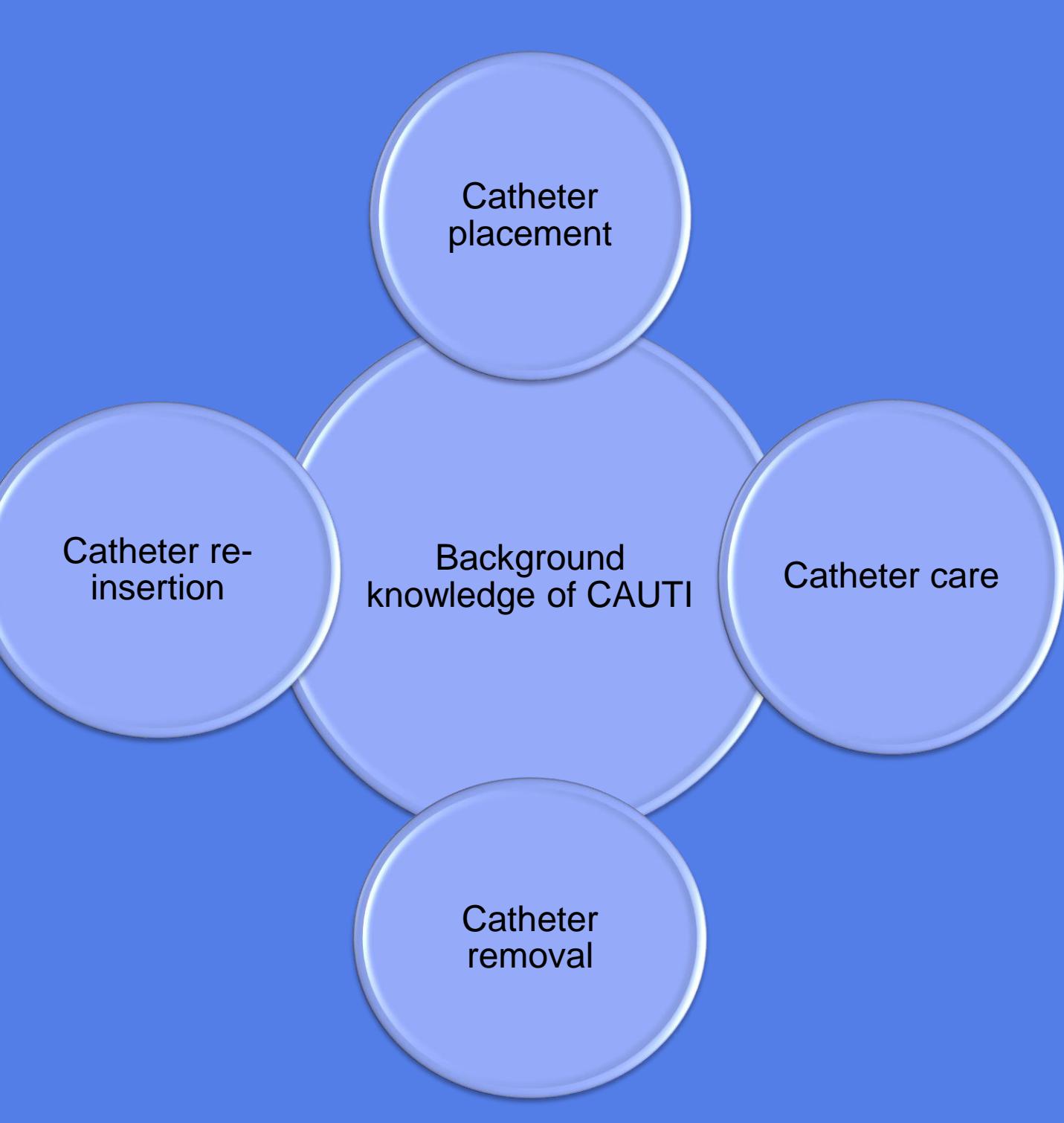


Figure I: Extended catheter lifecycle model

Study I: Delphi rounds and workshop

- 51 experts in the relevant fields of speciality from different parts of the world participated in the first Delphi round
 - Majority were IPC specialists followed by clinical microbiologists
 - Items ratings was on a 5-point Likert scale
 - Most items received the Delphi participants agreement of 70% and above
 - Free-text topic suggestions considered and analysed
- A brainstorming experts' workshop deliberated on topic suggestions
 - Provided further interpretations of some items and contextual meaning to the free-text responses
 - 12 more items generated
 - Checked for readability before the second Delphi round
- 25 experts participated in the second Delphi round and rated the 76 on a 5-point Likert scale
 - Mainly from HIC
 - Negatively worded items did not make the 70% consensus
 - Provided item wordings suggestions
- Further items considered from the Ann Arbor criteria
- Based on a set criteria, items were further developed/modified
- 115 items generated and transformed into “correct and incorrect” responses
- Readability and comprehensibility checked

Table I: Demographics of the first Delphi survey participants

Country (WB Classification)	Profession (n)	Specialty (n)	Years of experience		
			Low	Medium	High
HIC	Nursing	1	Infection control	1	
HIC	Nursing	Infection control	7		1
				1	6
	Medicine	1	Infection control	1	
HIC	Nursing	1	Infection control	1	
HIC	Nursing	1	Infection control	1	
LMIC	Nursing	1	Infectious diseases	1	
HIC	Medicine	Infection control	1		1
				1	
	Nursing	1	Infection control	1	
HIC	Nursing	Infection control	6		1
				1	5
			Urology	1	
			Others	1	
	Medicine	Infectious diseases	1		1
				1	
	Nursing	Infectious diseases	2		2
				2	
LMIC	Medicine	Clinical microbiology	3		3
	Nursing	Infection control	6	1	2
				1	3
HIC	Nursing	Infectious diseases	2		1
				1	
	Others	1			
None	Medicine	Others	1		1

Table II: Items pool and development from Delphi round and workshop

Original item	Delphi 1 survey comment and consensus level (%) (N=51)	Comments from Workshop	Reformulated to correct/incorrect format	Delphi 2 survey comment and consensus level (%) (N=25)	Formulation of item taken forward
CAUTI accounts for up to around half of all healthcare associated infections (Gesmundo, 2016)	76% consensus		CAUTI accounts for about half of all healthcare associated infections (Gould et al., 2010)	72% consensus	Catheter associated urinary tract infection accounts for about half of all healthcare associated infections
CAUTI increases a patient's length of hospital stay (Gesmundo, 2016)	86% consensus	Consequences of getting an infection	CAUTI can increase a patient's length of hospital stay(Gould et al., 2010)	96% consensus	Catheter associated urinary tract infection can increase a patient's length of hospital stay
Patient age, gender and background medical condition can be important predictors of CAUTI (Gesmundo, 2016)	84% consensus	Which individuals/ patient groups are more at risk for CAUTI	Certain factors such as patient age and gender are not good predictors of CAUTI (Gould et al., 2010)	36% consensus	Certain factors such as patient age and gender are not good predictors of catheter associated urinary tract infection
Following a catheter removal, some patients may take hours before they could independently void, thus re-insertion should not be rushed (RCN, 2021)	82% consensus	If a patient is unable to void immediately after catheter removal, another catheter should be re-inserted (RCN, 2021)	16% consensus Item was reformulated and taken forward previous Delphi round	If a patient is unable to void immediately after catheter removal, another catheter should be re-inserted	

Study II: Psychometric testing of items

Items were rolled out to comprehensively evaluate their psychometric performance

- Frontline healthcare professionals and students as the target population
 - 272 respondents from HIC and LMIC recruited through professional groups and social networks
- Psychometric evaluation completed using R statistical software
- Item's empirical structure and potential misfit were explored
 - CFA based on two empirical assumptions
 - EFA based on the CFA model
 - Loadings (> 0.30) are considered theoretically justifiable on intended factor

Item analysis

The items analysis was based on the theoretical allocation of the items to the domains of the extended catheter lifecycle model.

- Items were evaluated as whether they were too easy or too difficult for target population. Item's ability to discriminate respondents with low and high levels of knowledge was also investigated.
- For the difficulty index, results between 0.30 and 0.70 were considered appropriate.
- For the discrimination index, items with correlations ≥ 0.30 were considered acceptable
 - $N = 44$ items appeared too easy for the sample population
 - $N = 16$ items appeared too difficult
 - The items equally showed lower level of discrimination ability
- The remaining items showed acceptable levels difficulty and discrimination indexes, while those reported above are being further investigated.

Confirmatory factor analysis

The confirmatory factor analysis (CFA) was based on 2 assumptions:

- A five-dimensional model where each domain is represented by its own factor and allowed to correlate
- A unidimensional model that assumes one general factor of “CAUTI prevention knowledge”

The five-dimensional model showed adequate structural validity with very good cross-domain variance.

- A five-dimensional model fit the data
 - Most items loaded ≥ 0.30
- The loadings are indicative high correlation among the set of items and a good representation of the conceptual model

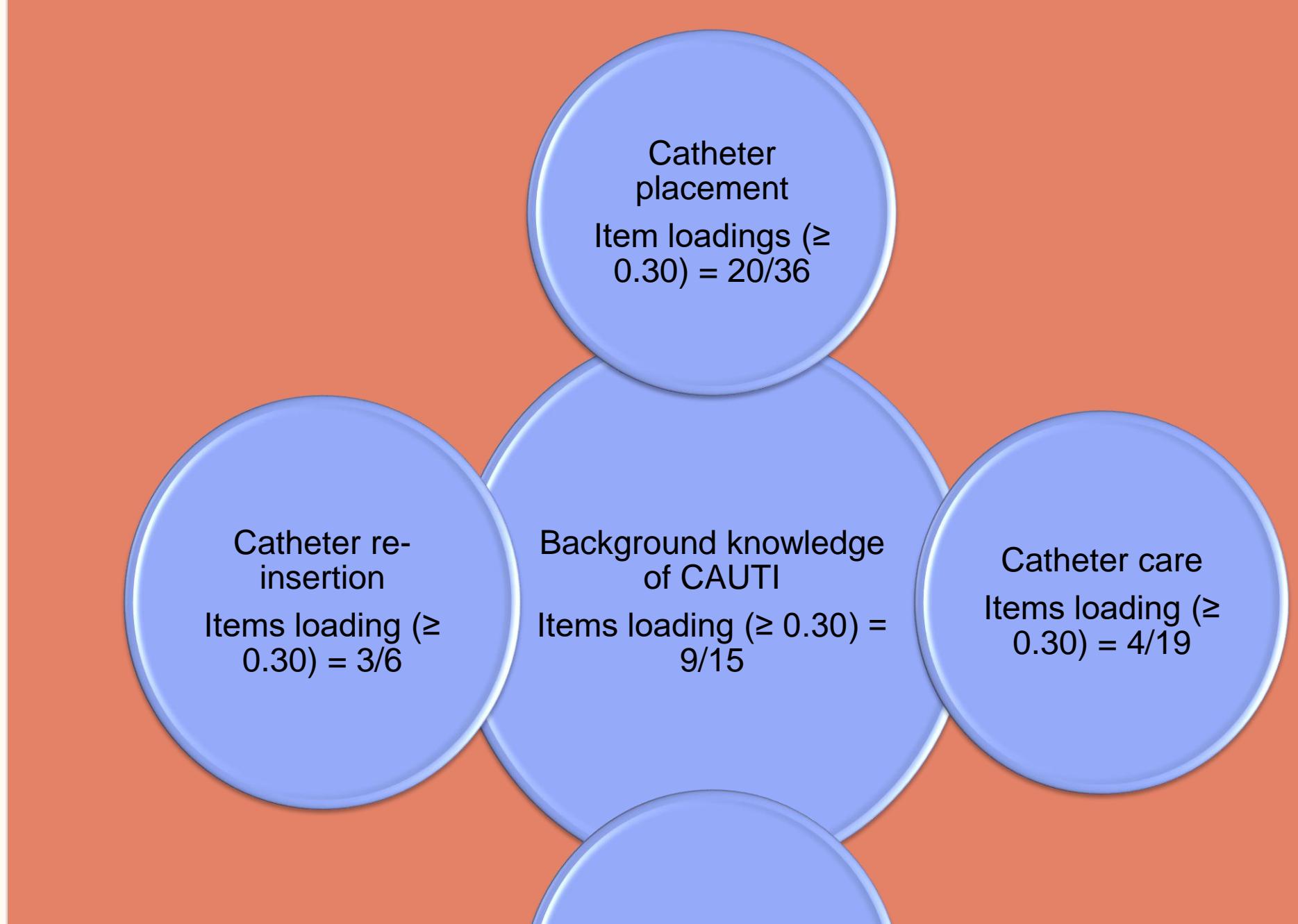
Unidimensional model is being investigated

Exploratory factor analysis

Items with difficulty levels of 0.05 and below/ 0.95 and above excluded from the EFA

Parallel analysis completed using weighted least squares method and oblimin rotation

- Factor extraction was based on the extended catheter lifecycle model
- Eigenvalues ranging from 3.73 (lowest) to 14.45 (highest)
- Items loadings are in agreement with the proposed five-dimensional model
- The loadings demonstrate good correlation between the designated items and a clear depiction of the extended catheter lifecycle model



Discussion or conclusions

We established that effective measurement of CAUTI prevention knowledge in healthcare professionals should cover the components of the five-dimensional model. Items with acceptable levels of difficulty and discrimination indexes and theoretically justifiable factor loadings, which are indicative of a strong correlation with the extended catheter lifecycle model, formed the scale. These items are taken forward for further validation.

References

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