MCI Classification in the Longitudinal Aging Study in India Diagnostic Assessment of Dementia (LASI-DAD)

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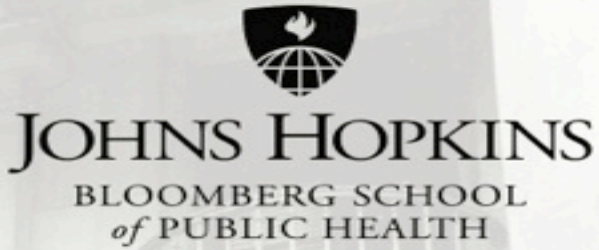


Background

- There is strong interest in comparing prevalence of cognitive impairment across countries around the world
- HRS leads a family of international partner studies, however deep cognitive phenotyping is lacking
- Harmonized Cognitive Assessment Protocol (HCAP) projects are designed to facilitate collaborative efforts aimed at cross-national comparisons
- To date, HCAP surveys have been completed in India, Mexico, England, China, EU, and S. Africa
- LASI-DAD (N=4,096) is a substudy of the Indian LASI study (N~70,000)

Outline

- Establish **algorithmic criteria** for MCI based on available information in LASI-DAD
  - Apply an approach based on comprehensive neuropsychological criteria using robust norms developed for MexCog
- We have studied 30 adaptations of Petersen's original and revised criteria (Petersen, 2004) to LASI-DAD
  - Not the focus of this talk

Adjudication did not work well for MCI

- Thus, we are interested in algorithmic approaches
- Clinicians rated LASI-DAD participants on a CDR using an online website
  - Dementia assignment corresponds with in-person clinical assessment, kappa=0.76 (Lee et al., in review)

Final CDR rating	Freq.
0	748
.5	1,537
1	161
2	25
3	5

1537/2476 cases (62%) with CDR=0.5
Believable? Probably not.

Challenges to Online Diagnosis

Insufficient information, e.g.,

- Nature and severity of physical disability which might explain some of the functional deficits that might otherwise be cognitive in origin;
- Underlying medical conditions and how they may affect cognition

Inconsistent information, e.g.,

- Participant performs perfectly on brief memory test but reports subjective difficulties
- Participant and informant provide contradictory information
- Informant provides inconsistent information on different scales

Illiterate participants

When memory is intact but other domains are impaired

Different language than interviewer

High scores on depression scale

Information available in LASI-DAD

Figure 2. LASI-DAD Protocol

Cognitive Tests

1. Hindi Mental State Exam
2. HRS TICS*
3. Word learning: immediate recall*
4. Digital span forward and backward
5. Symbol cancellation
6. Word list delayed recall*
7. Word list recognition
8. Logical memory: immediate recall
9. Constructional praxis: copy*
10. Logical memory delayed recall
11. Logical memory recognition
12. Retrieval fluency*
13. Constructional praxis recall
14. Backward count (Phase 1 only)
15. Hand sequencing (Phase 2|3 only)
16. Token test (Phase 2|3 only)
17. Judgment (Phase 2|3 only)
18. Serial 7s*
19. CSI-D*
20. Raven's matrices
21. Go-No Go

Informant Interview

1. Informant's relationship with R
2. Jorm's IQCODE*
3. Blessed Dementia Rating Scale
4. CSID Cognitive Activities Questionnaire
5. 10/66 Informant Questionnaire

BLUE font indicates a modification from the HCAP protocol

* Indicates tests also administered in the main LASI

Factor structure of cognition in LASI-DAD

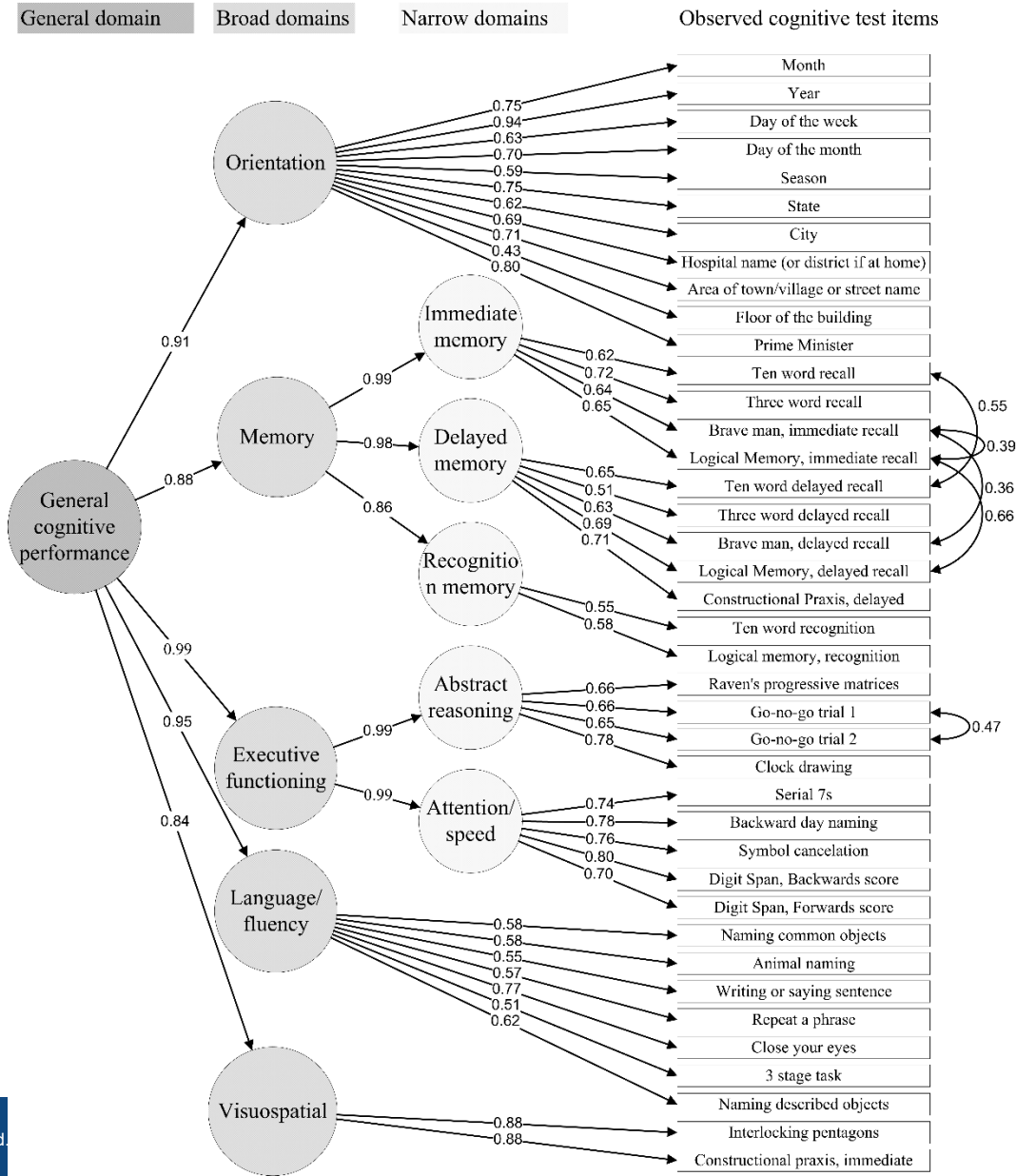
Measurement and Structure of Cognition in the Longitudinal Aging Study in India–Diagnostic Assessment of Dementia

Alden Gross, PhD, MHS, Pranali Y. Khobragade, MD,† Erik Meijer, PhD,† and Judith A. Saxton, PhD†*

OBJECTIVES: To test whether a relatively complex model of human cognitive abilities based on Cattell-Horn-Carroll (CHC) theory, developed mainly in English-speaking samples, adequately describes correlations among tests in the Longitudinal Aging Study in India–Diagnostic Assessment of Dementia (LASI-DAD), and to develop accurate measures of cognition for older individuals in India.

CONCLUSION: We demonstrated configural factorial invariance of a cognitive battery in the Indian LASI-DAD using CHC theory. Broad domain factors may be used in future research to rank individuals with respect to cognitive performance and classify cognitive impairment. J Am Geriatr Soc 00:1-9, 2020.

Keywords: Harmonized Cognitive Assessment Protocol;



Gross et al., JAGS, 2020

How to operationalize MCI criteria in LASI-DAD?

Adaptation of Petersen's original and revised criteria (Petersen, 2004)

- We have studied 30 adaptations to LASI-DAD

Comprehensive neuropsychological criteria using robust norms (Arce et al., in review)

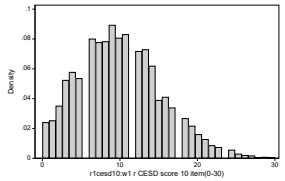
- We followed procedures set forth by MexCog researchers

How to operationalize MCI criteria in LASI-DAD?

- Comprehensive neuropsychological criteria using robust norms
  - Identified a robust normative group (N=403, 10% of sample)
    - No cognitive impairment, no history of stroke, low depressive symptom count, no informant-reported functional decline or impairment based on CSID, no evidence of functional decline based on 10/66 items
  - In the robust subsample, regress domain-specific cognitive factors on age, sex, education
  - Estimated residuals
  - MCI defined as 1.5 SD below the mean of any domain-specific residual

Identifying a normative group: Work in progress

- No history of dementia or low cognition
  - Leverage data from the parent LASI study
- No history of stroke
  - Easy to implement
- Low depressive symptom count
  - Difficult! Translation problem for some items?

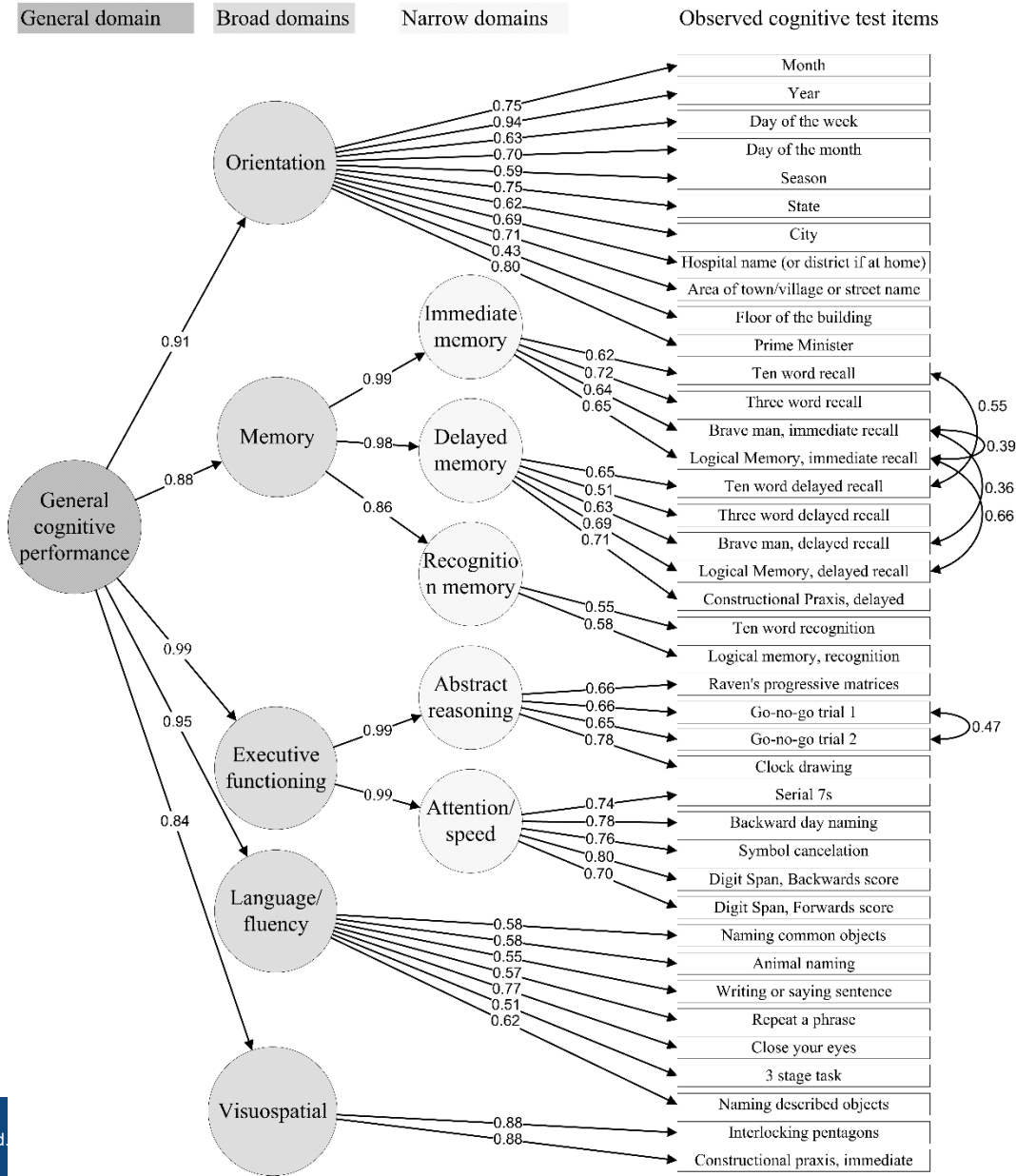


- No informant/self-reported functional decline
  - Only asked in phases 2,3, not phase 1
- No impairment based on CSID
  - Complicated
- No evidence of functional decline based on 10/66 items
  - Easy to implement (*problems handling money; stopped hobbies*)

Next step: regress domain-specific cognitive factors

We'll just use factor scores directly from that published hierarchical CFA!

Right?



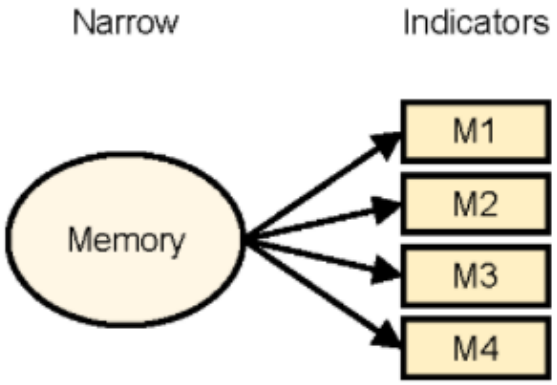
Gross et al., JAGS, 2020

Prevalence of MCI, based on factors from hierarchical CFA

- Domain-specific prevalences of MCI are similar, but overall prevalence of any MCI is much lower in LASI-DAD
  - How?
  - The factor scores are all correlated at r>0.9
- Let's look back at the hierarchical CFA and its assumptions

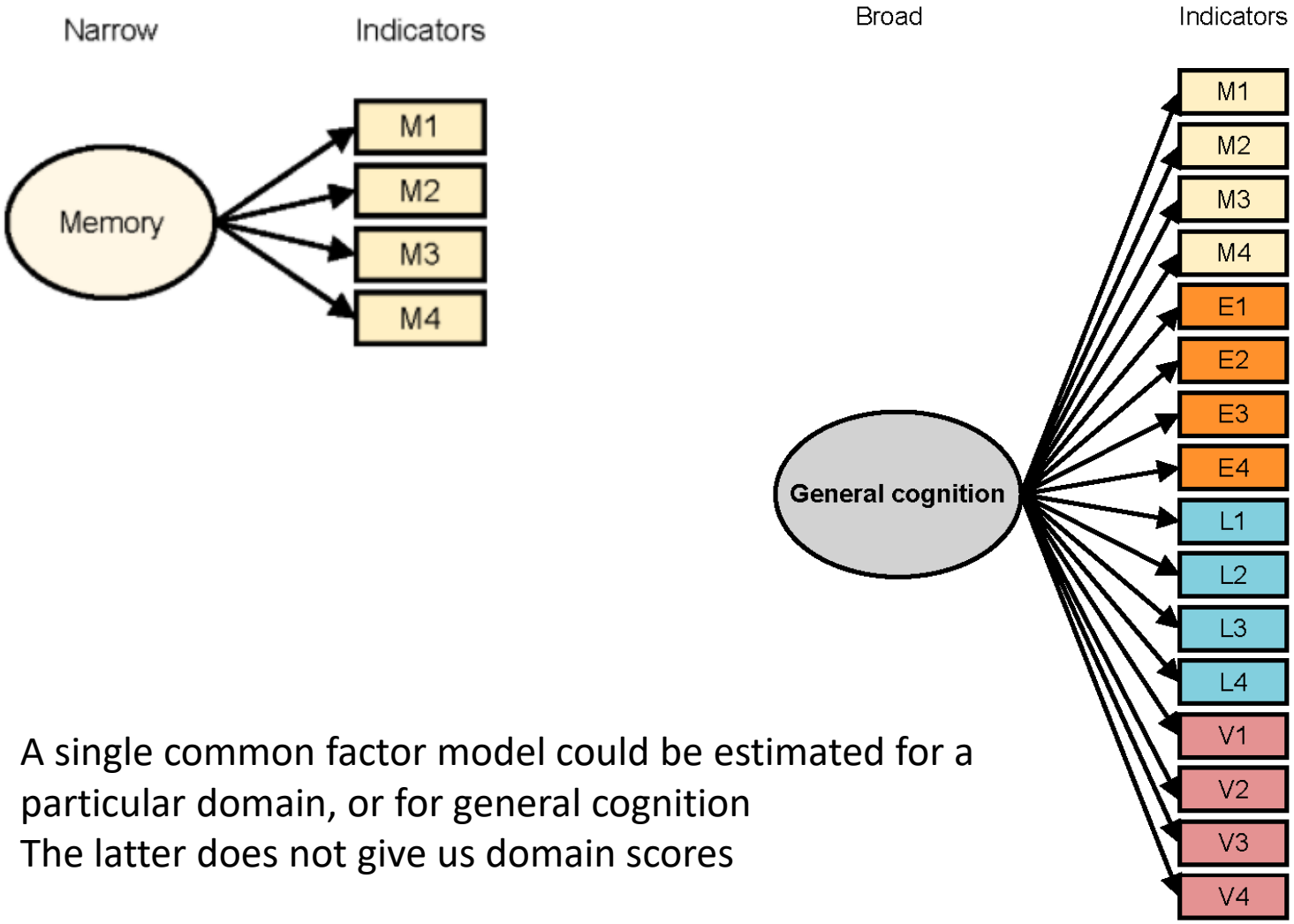
MCI subtype	LASI-DAD	MexCog
Any	12.5	34.4
orientation	6.3	
Memory	5.7	5.9
Language	6.1	4.3
Visuospatial	6.5	7.7
Executive	5.8	4.2
Multiple domain, not memory	6.8	5.3

Confirmatory factor analysis



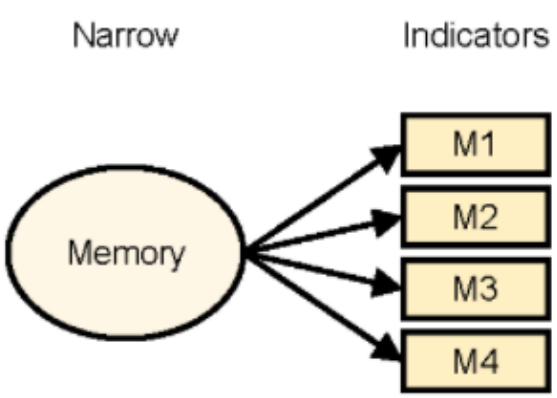
- This is a single common factor model for a specific domain
- Latent variables in circles, represent common covariation among the observed indicators, in boxes

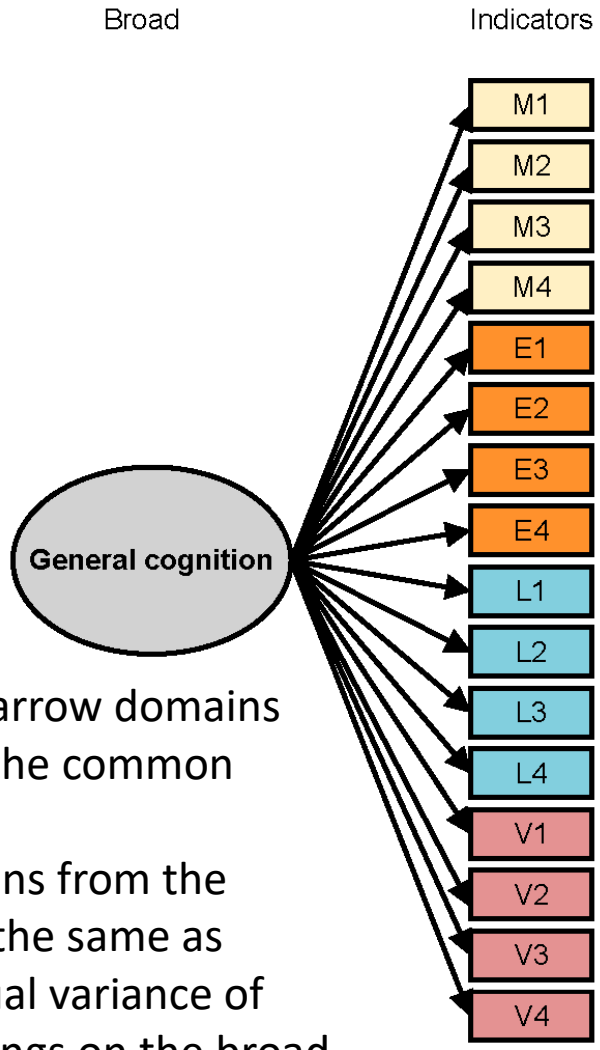
Confirmatory factor analysis

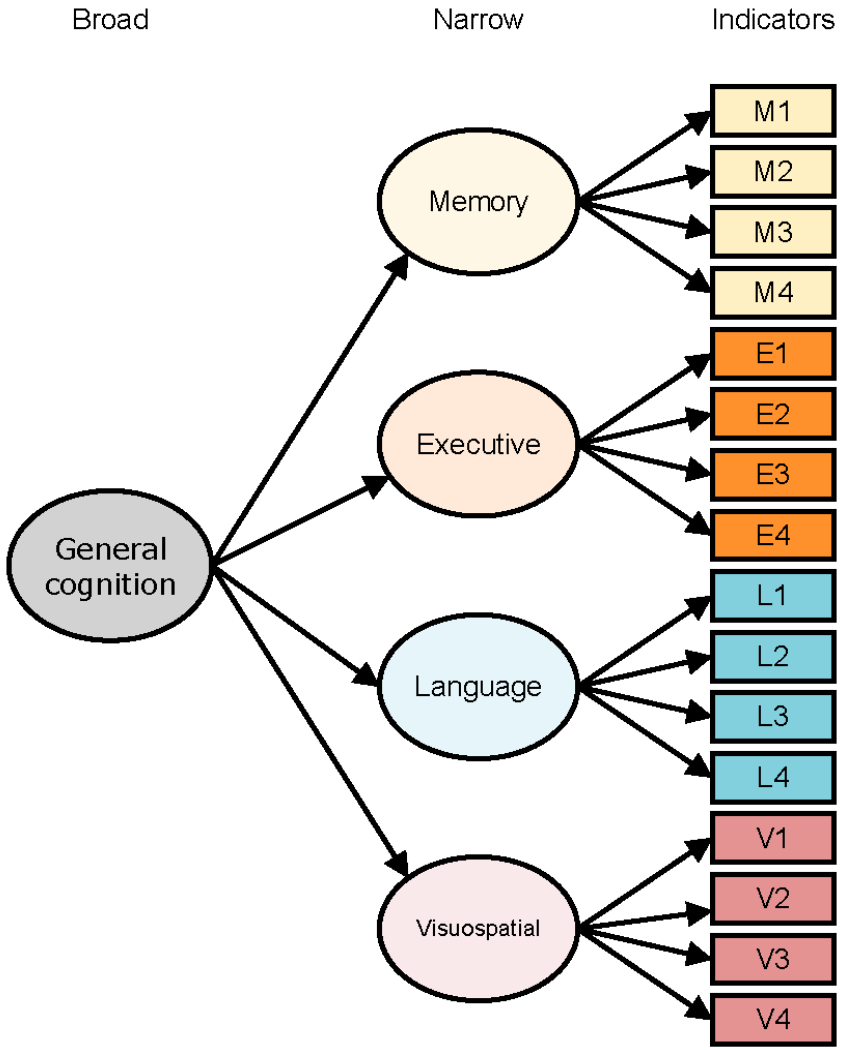


- A single common factor model could be estimated for a particular domain, or for general cognition
- The latter does not give us domain scores

Confirmatory factor analysis



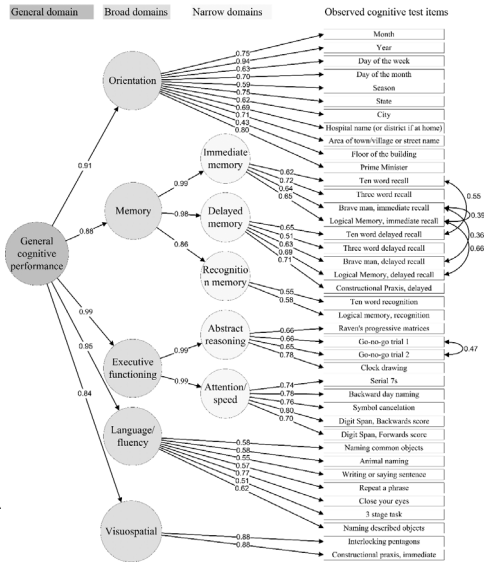


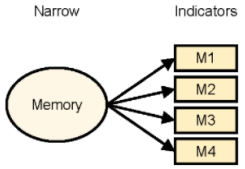


- We can augment this second model with narrow domains
- Such a hierarchical model is nested within the common factor model
- However, latent variables for narrow domains from the hierarchical common factor model are not the same as those at far left - unless we force the residual variance of the narrow factors to be 0 and for the loadings on the broad general cognition factor to be 1 (perfect relationship)

Confirmatory factor analysis

- That is to say, if we assume that
  - (1) the loadings of the broad “General cognition” factor in each narrow factor was 1,
  - (2) the residual variance of the narrow factors was 0,
  - (3) the loadings and thresholds of indicators are the same a domain-specific single common factor models
- Then the single common factor model and the hierarchical common factor model would be identical.
- We typically would not impose such restrictions; to go to such lengths would return us to domain-specific single common factor models.
- So why don’t we just use the single factor model





Prevalence of MCI

MCI subtype	LASI-DAD - hierarchical factors	LASI-DAD - single domain factors	MexCog
Any	12.5	22.0	34.4
orientation	6.3	7.5	
Memory	5.7	5.9	5.9
Language	6.1	7.0	4.3
Visuospatial	6.5	7.7	7.7
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Conclusions

Main conclusions

- Hierarchical factor analysis is useful for describing the factor structure of a test battery
  - Conforms to CHC theory of human cognitive abilities
- BUT, for empirical estimation of factor scores, use domain-specific single domain models

Other

- Much still needs to be done in developing cross-nationally comparable algorithms to compare MCI

Conclusions

- Ultimately, any approach will have advantages and disadvantages
- Our overall strategy will be to evaluate a variety of methods using data for criterion validation from future study waves

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