Development and Validation of CHROME-CVD in China

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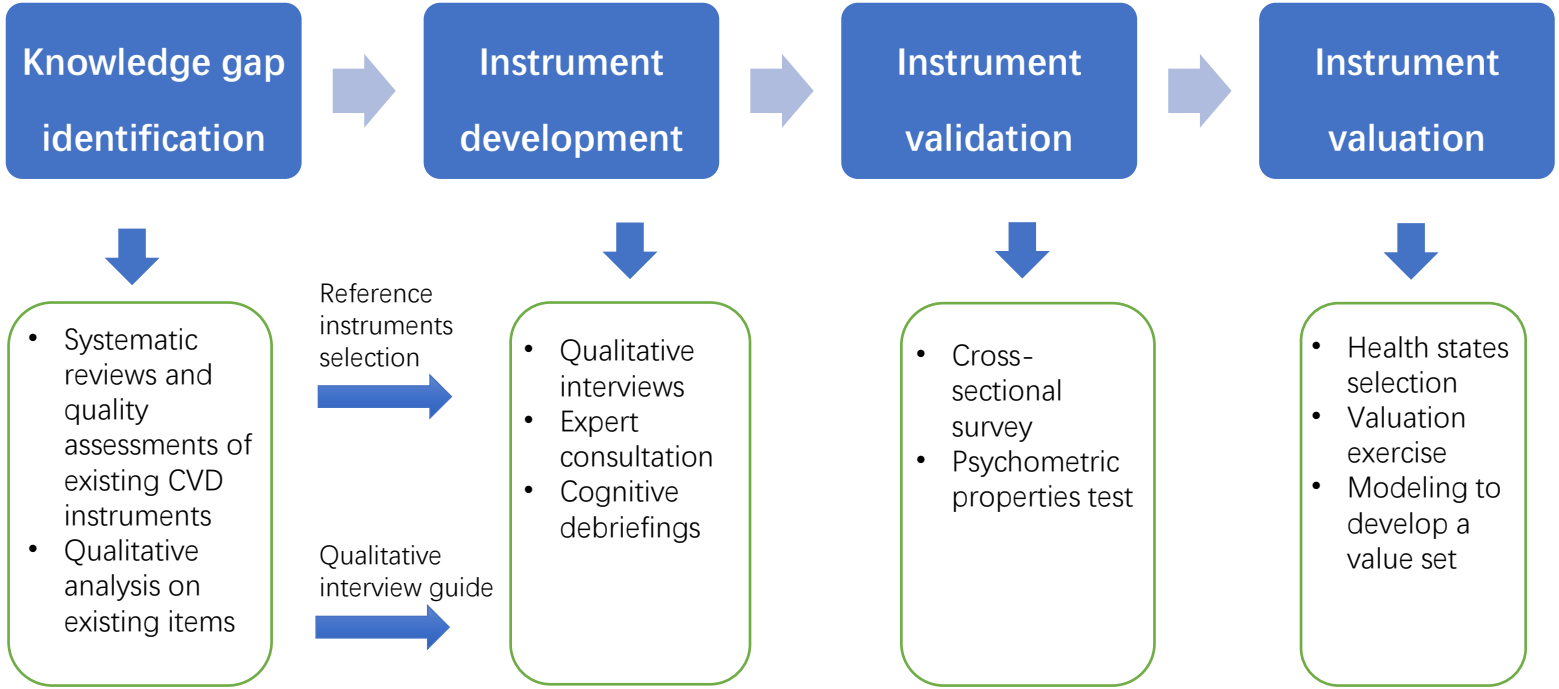
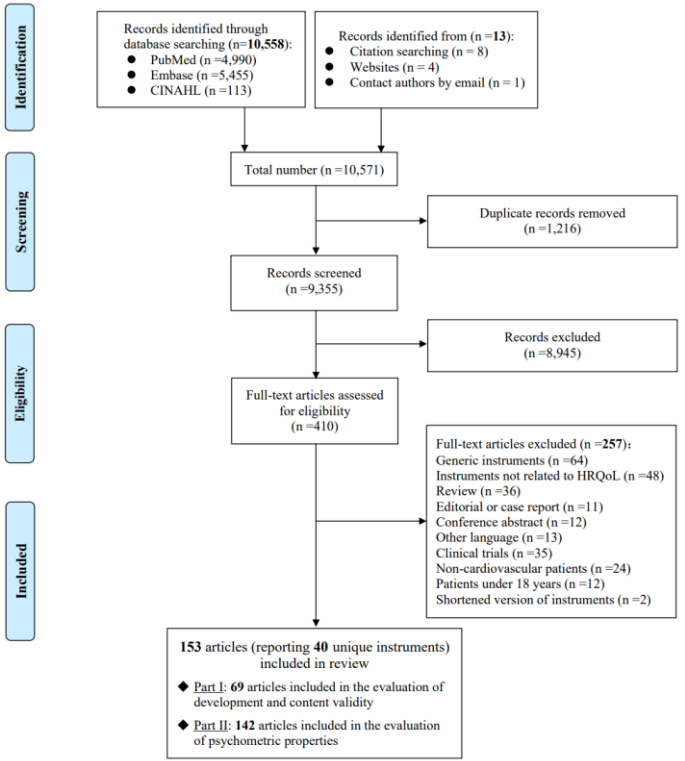
Research Design



HRQoL instruments in CVDs

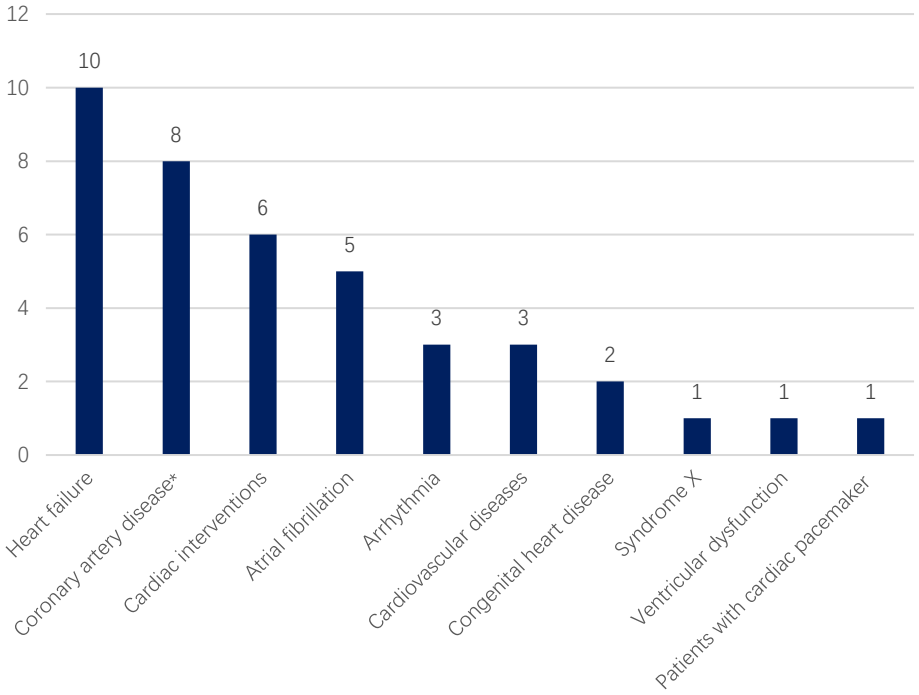
- Two manuscripts (published on Value in Health in April 2024):
  - Content validity
  - Other psychometric properties: structural validity, internal consistency, reliability, construct validity (convergent, divergent, discriminant), responsiveness
- Objectives:
  - To understand the quality of existing instruments and knowledge gaps during development and validation;
  - To select the most appropriate reference instruments for construct validity test of CHROME-CVD;
  - To guide the development of interview guide for patient interviews.
- Methods:
  - COSMIN guidelines for systematic reviews and quality assessments;
  - Content analysis to identify and compare key HRQoL constructs of instruments identified.



Study selection process

COSMIN: the Consensus-based Standards for the selection of health Measurement Instruments (COSMIN) methodology

Results of SRs



Number of instruments in each type of CVD

- 40 instruments were included
  - Except UBQ-H, none of the instruments are preference-based
- Content validity:
  - **5 (12.5%) instruments** were rated "sufficient" with "moderate" quality of evidence.
- Other psychometric properties:
  - **No instruments** were rated "sufficient" on all psychometric properties.
  - **Only 2 (5.0%) instruments**, namely MLHFQ and MacNew, were supported by moderate or high quality of evidence consistently across remaining properties (except content validity).

Review > Value Health. 2024 Apr 10:S1098-3015(24)02331-3. doi: 10.1016/j.jval.2024.04.001. Online ahead of print.

A Systematic Review and Quality Assessment of Cardiovascular Disease-Specific Health Related Quality of Life Instruments Part I: Instrument Development and Content Validity

Xue Li [1], Rui Li [2], Meixuan Li [3], Liang Yao [4], Harriette Van Spall [5], Kun Zhao [6], Yunxiang Chen [7], Feiyi Xiao [8], Qiang Fu [8], Feng Xie [9]

- Coronary artery disease: including coronary heart disease, myocardial infarction, ischemic heart disease and
- Syndrome X: patients with chest pain and normal coronary arteriogram

Key findings of SRs

- Quality of psychometric properties of existing HRQoL instruments in CVDs were suboptimal.
- Common issues in terms of psychometric properties:
  - Lack of description about the origin of instruments' constructs; poor representativeness of the sampling populations; inadequate description of concept elicitation process; a general lack of cognitive interviews or pilot testing.
  - Lack of evidence on structural validity;
  - Lack of evidence on responsiveness;
  - Low quality data on test-retest reliability.
- Core concepts of HRQoL were identified:
  - Emotional distress, physical limitation, disease symptoms, social relationship, social activities .
- Three reference instruments with relatively high quality: HeartQoL, MLHFQ, AFEQT

HeartQoL: The Ischemic Heart Disease specific HRQL questionnaire;
MLHFQ: The Minnesota Living with Heart Failure Questionnaire;
AFEQT: The Atrial Fibrillation Effect on Quality of Life

Development of CHROME-CVD

- 15 Provinces
- 135 patients

- Qualitative one-on-one face-to-face in-depth interviews with 135 patients (127 valid respondents)
- Content analysis was employed to generate initial item pool
- Expert survey and consultation (n=15) for instrument revision
- Cognitive interviews with patients (n=20) and physicians (n=13)

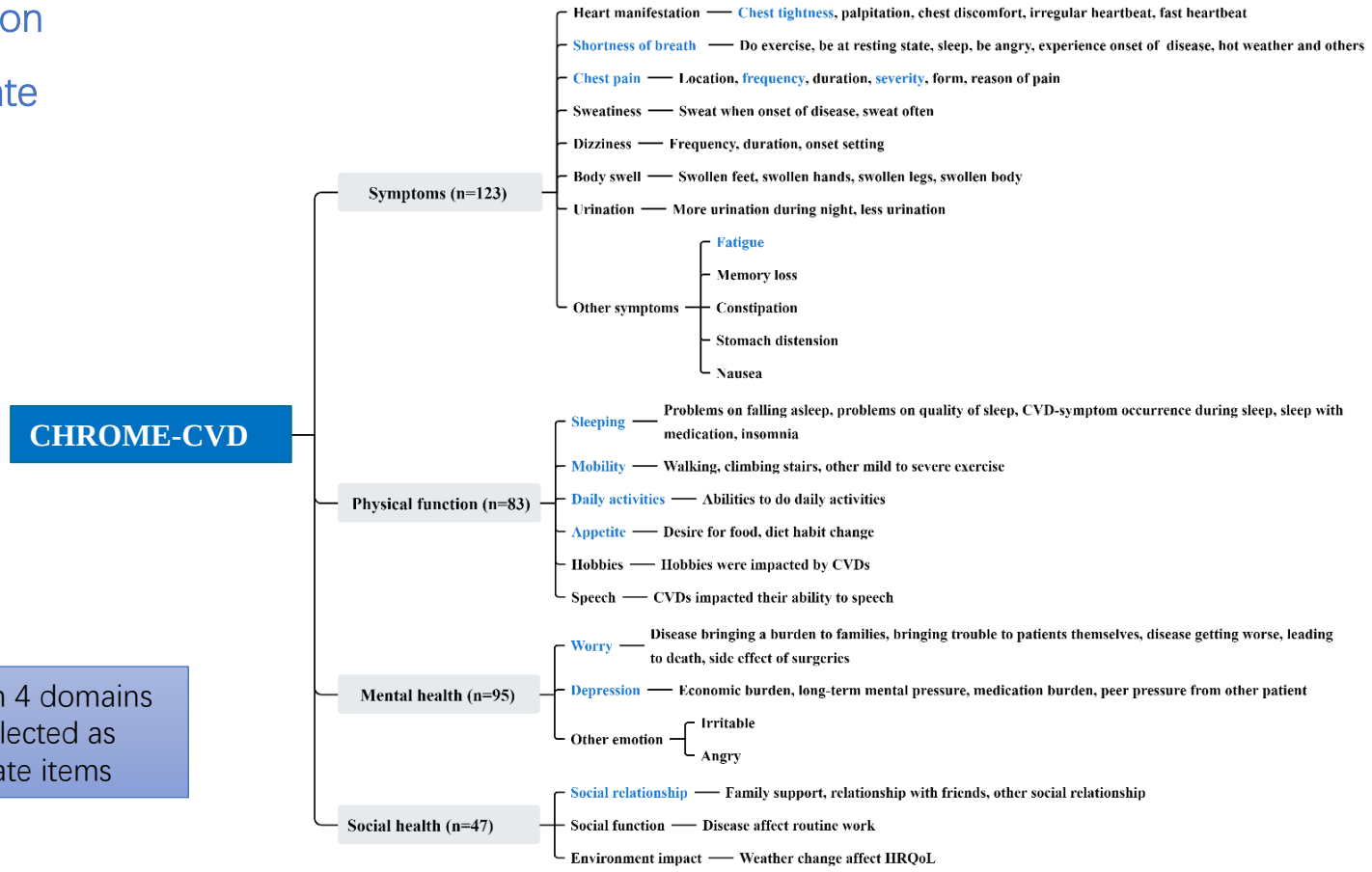
Published: 29 April 2023

China Health Related Outcomes Measures (CHROME): development of a descriptive system to support cardiovascular disease specific preference-based measure for the Chinese population

Xue Li, Kun Zhao, Kexin Li, Wenjun Wang, Siting Feng, Jing Wu, Xiaoning He, Shitong Xie, Hao Hu, Jing Fan, Qiang Fu & Feng Xie For the CHROME Study Group

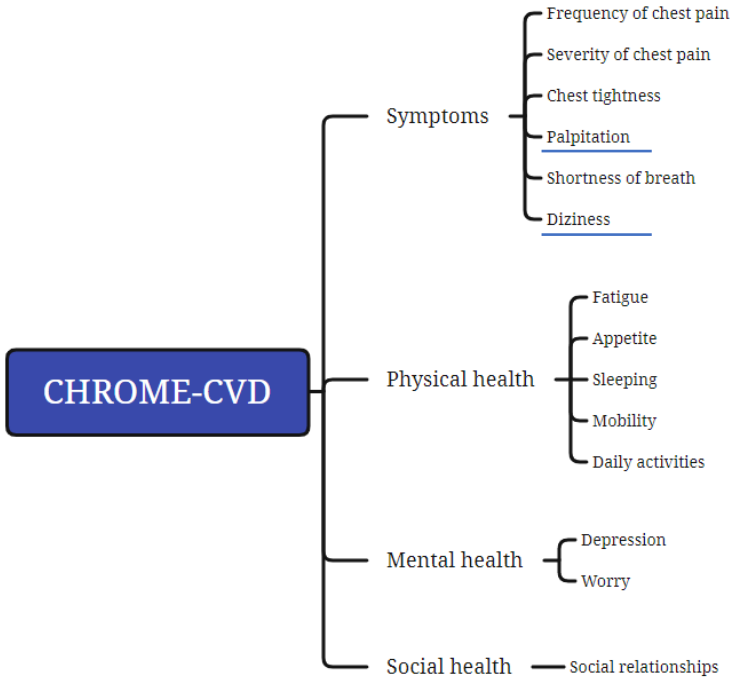
Quality of Life Research (2023) | Cite this article

Identification of candidate items



12 items in 4 domains were selected as candidate items

Development of CHROME-CVD



Structure of CHROME-CVD for validation

- Revised version (version 2) after expert consultation: 13 items
  - Recall period selection: today or the past 7 days
  - Added one item: dizziness (33/127, 26%)
- Revised version (version 3-5) after cognitive debriefings: 14 items
  - Confirmed recall period: the past 7 days
  - Added one item: palpitation (22/127, 17%)
  - Response options: 4 or 5 levels

Validation of CHROME-CVD

eTable 2 Measurement properties evaluated in this study

Measurement properties	Prespecified criteria
Item evaluation	
Item characteristics	Ceiling and floor effects < 10%;
	IRT: IIF to identify redundant or less useful items; CRCs to evaluate the appropriateness of responses
Remaining measurement properties	
Test-retest reliability	ICC≥0.70
Construct validity	**Convergent validity**: correlation coefficients of similar items/domains≥0.5; **Discriminative validity**: Correlation coefficients of related but dissimilar items/domains: < 0.5, Known-group analysis detected significant differences among patients classified by the NYHA. Scores of patients classified in NYHA III/IV are significantly higher than that of patients in NYHA I/II.
Internal structure	
Structural validity	CTT: CFA: RMSEA < 0.06 and TLI > 0.95
Internal consistency	Cronbach's alpha coefficient ≥0.70
Measurement invariance	IRT: No important differences to be found between groups for DIF

CTT=classic test theory, IRT=item response theory, IIF=item information function, CRC=categorical response curves, NYHA= New York Heart Association classification, CFA=confirmatory factor analysis, RMSEA= the root-mean-square error of approximation, TLI=Tucker-Lewis index, DIF= Differential item functioning, ICC= intra-class correlation coefficient

- Study design: cross-sectional study following COSMIN methodology
- Theories:
  - Classical test theory (CTT): evaluate the psychometric properties
  - Item response theory (IRT): evaluate each item and corresponding responses
- Stratified cluster sampling:
  - Age, sex, type and severity of CVDs
- Type of CVDs: CAD, HF and AF.
- Reference instruments:
  - HeartQoL: Coronary artery disease (coronary artery disease, angina and myocardial infarction)
  - MLHFQ: Heart failure
  - AFEQT: Atrial fibrillation
  - EQ-5D-5L: all patients

HeartQoL: The Ischemic Heart Disease specific HRQL questionnaire;
MLHFQ: The Minnesota Living with Heart Failure Questionnaire;
AFEQT: The Atrial Fibrillation Effect on Quality of Life

Initial validation of CHROME-CVD

Geographic distribution of the initial validation

- 6 Provinces
- 480 patients (444 valid respondents)

Table 1 Characteristics of patients (n=444)

	n (%)
Age	
35-64	179 (40.32%)
65-84	265 (59.68%)
Sex (male)	267 (60.14%)
Residency	
Urban	269 (60.59%)
Rural	175 (39.41%)
Province	
Zhejiang	58 (13.06%)
Heilongjiang	68 (15.32%)
Liaoning	70 (15.77%)
Fujian	75 (16.89%)
Jiangsu	85 (19.14%)
Hubei	88 (19.82%)
Education	
Primary school or below	202 (45.50%)
Middle school	131 (29.50%)
High school	75 (16.89%)
College and above	36 (08.11%)
Type of CVDs	
AF	16 (3.60%)
HF	104 (23.42%)
CAD	324 (72.97%)
Classification of NYHA	
I	106 (23.87%)
II	148 (33.33%)
III	113 (25.45%)
IV	77 (17.34%)

NYHA: the New York Heart Association Functional Classification

Results of initial validation

- Response burden: 3.0 (1.1) minutes, ranging from 1.3 to 5.6 minutes
- Item evaluation:
  - Ceiling effect: 5.2%; floor effect:0;
- Structural validity:
  - Four domains were identified: chest pain, other symptoms, physical health, mental and social health;
  - Internal consistency: Cronbach's Alpha: 0.89;
  - Measurement invariance: except the item "appetite", no important difference was identified.

Table 3 Factor loadings of CHROME-CVD items

Items	Factor loadings of factor analysis			
	Factor 1	Factor 2	Factor 3	Factor 4
Chest pain-frequency				0.86
Chest pain-severity				0.82
Chest tightness		0.67		
Palpitation		0.72		
Shortness of breath		0.67		
Dizziness		0.41		
Fatigue	0.48			
Appetite	0.50			
Sleeping	0.44			
Mobility	0.76			
Daily activities	0.67			
Depression			0.78	
Worry			0.78	
Social relationship			0.48	

Note: factor loadings below 0.4 were not listed in this table

Results of initial validation

- Test-retest reliability: ICC=0.94 (95% CI: 0.87-0.97);
- Construct validity:
  - Convergent validity: 20/26 (76.9%)
  - Discriminant validity: 90/95 (94.7%)
- Known-groups validity: significant difference between NYNA I/II and NYNA III/IV

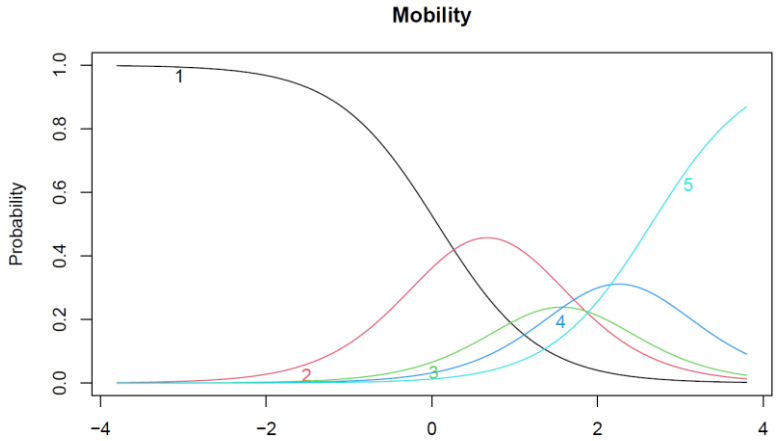
Value Health. 2024 Apr;27(4):490-499. doi: 10.1016/j.jval.2024.01.003. Epub 2024 Jan 18.

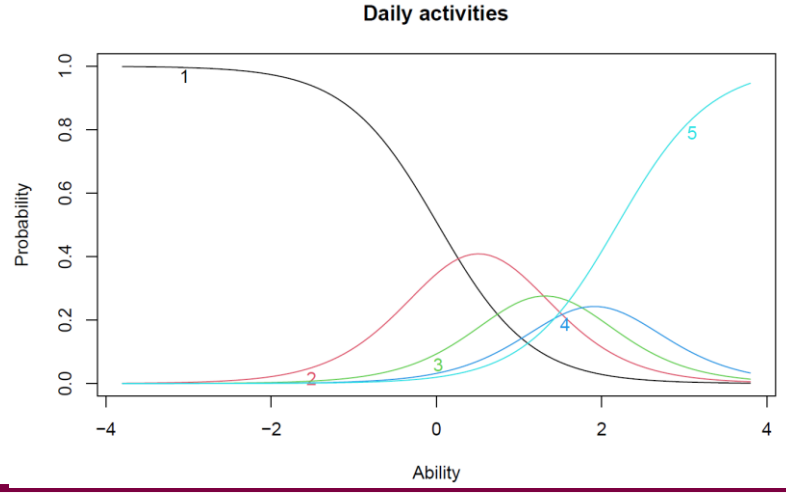
Validation of China Health-Related Outcomes Measures-Cardiovascular Disease

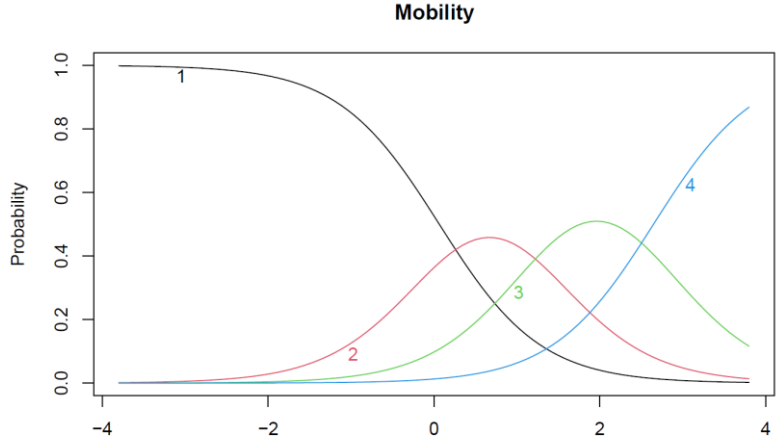
Xue Li [1], Rui Li [2], Feiyi Xiao [3], Kun Zhao [4], Xiaolu Zhang [5], Xinyi Wang [5], Meichen Li [5], Ke Guo [6], Li Wang [7], Yanan Wu [6], Harriette Van Spall [8], Tiantian Gao [9], Qiang Fu [10], Feng Xie [11];
CHROME Study Group

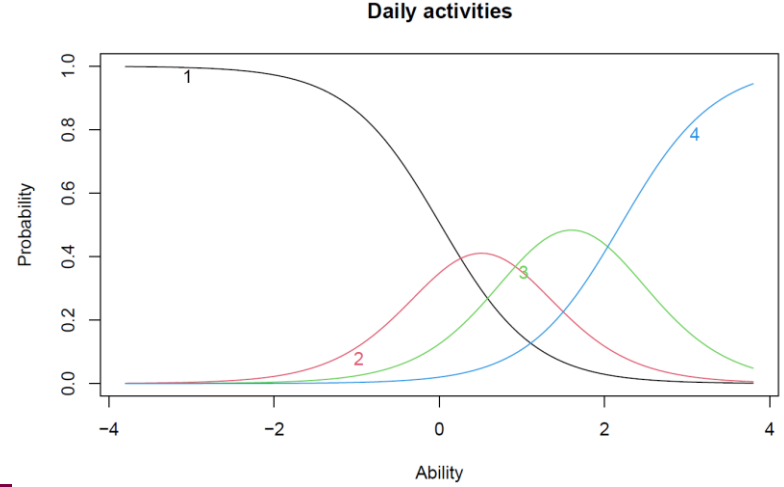
ICC: intra-class correlation coefficient
NYHA: the New York Heart Association Functional Classification

Before









After

Item category response curves (CRCs) of CHROME-CVD

Revisions of CHROME-CVD after initial validation

- Response options of nine items were modified to 4-level response options
- Wording of three items were modified by referring wordings of reference instruments.

Table 5 Items and responses revision after psychometric property tests

	Initial version before psychometric test		Revised version after psychometric test		
No.	Items	Responses	Items	Responses (4 levels)	Reason to revise
1	Frequency of chest pain	5-level: never, 2-3 times a week, three times a week but not every day, 1-3 times a day, more than 4 times a day	RETAIN	Never, sometimes, often, always	Overlap of CRCs
2	Severity of chest pain	4-level: no, mild, moderate, severe problems	RETAIN	RETAIN	--
3	Shortness of breath	5-level: never, seldom, sometimes, often, always	RETAIN	Never, sometimes, often, always	Overlap of CRCs
4	Chest tightness	5-level: never, seldom, sometimes, often, always	RETAIN	Never, sometimes, often, always	Overlap of CRCs
5	Appetite	5-level: no, mild, moderate, severe, extreme problems	RETAIN	No, mild, moderate, severe problems	Overlap of CRCs
6	Sleeping	5-level: no, mild, moderate, severe, extreme problems	RETAIN	No, mild, moderate, severe problems	Overlap of CRCs
7	Depression	4-level: no, mild, moderate, severe problems	RETAIN	RETAIN	--
8	Worry	4-level: no, mild, moderate, severe problems	RETAIN	RETAIN	--
9	Fatigue	4-level: no, mild, moderate, severe problems	RETAIN	RETAIN	--
10	Mobility	5-level: no, mild, moderate, severe, extreme problems	REVISE (Wording)	No, mild, moderate, severe problems	Better CRCs of reference instruments
11	Daily activities	5-level: no, mild, moderate, severe, extreme problems	REVISE (Add examples)	No, mild, moderate, severe problems	Better CRCs of reference instruments
12	Social Relationship	4-level: no, mild, moderate, severe problems	REVISE (Add examples)	RETAIN	Better CRCs of reference instruments
13	Dizziness	5-level: never, seldom, sometimes, often, always	RETAIN	Never, sometimes, often, always	Overlap of CRCs
14	Palpitation	5-level: never, seldom, sometimes, often, always	RETAIN	Never, sometimes, often, always	Overlap of CRCs

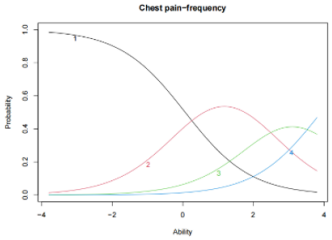
Further validation of CHROME-CVD

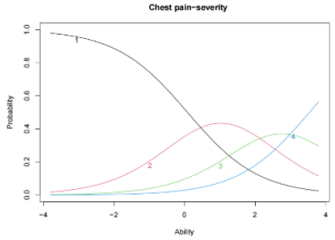
Geographic distribution of the further validation

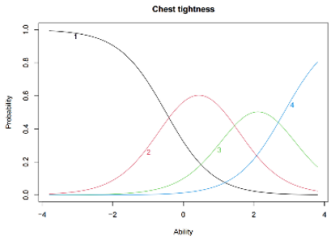
- 11 provinces
- 951 patients (921 valid respondents)

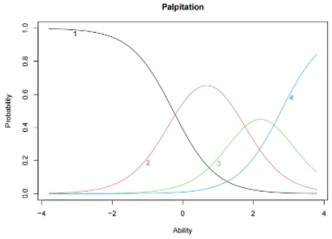
- To Evaluate psychometric properties of revised CHROME-CVD
- Results of psychometric properties tests were similar as initial validation
  - Response burden, ceiling and floor effects
  - Structural validity: CFA, internal consistency
  - Test-retest reliability, construct validity, known-groups validity
- Measurement invariance: sleeping, depression and worry were identified different between group of sex.

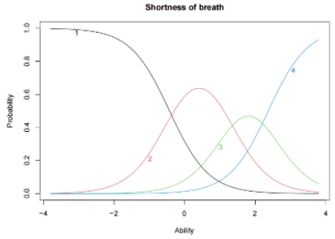
CHROME-CVD

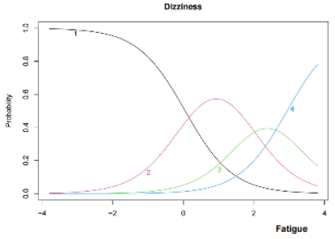

Chest pain–frequency
Probability
Ability

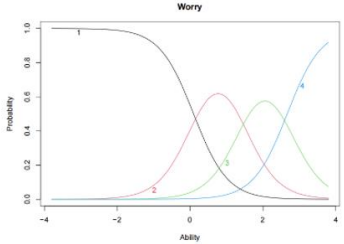

Chest pain–severity
Probability
Ability

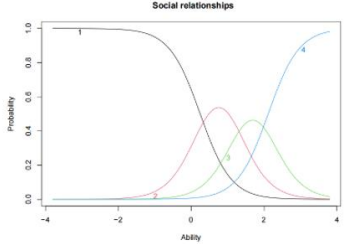

Chest tightness
Probability
Ability

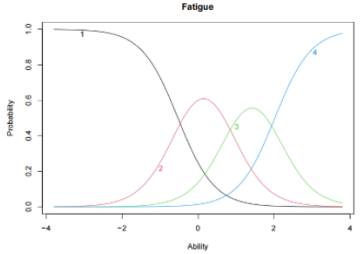

Palpitation
Probability
Ability

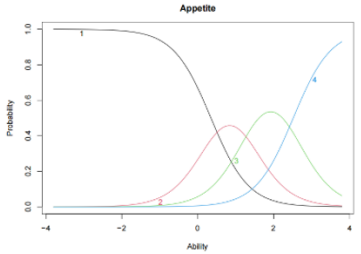

Shortness of breath
Probability
Ability

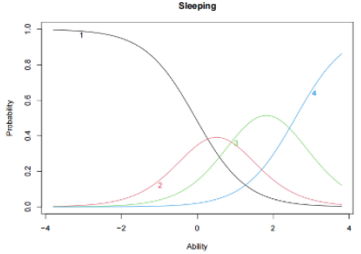

Dizziness
Probability
Ability

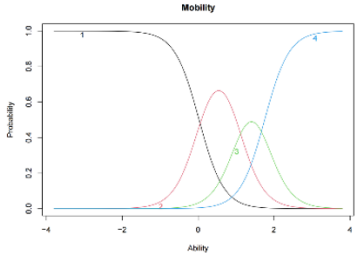

Worry
Probability
Ability

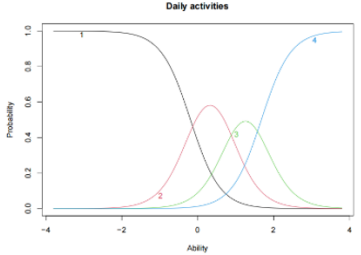

Social relationships
Probability
Ability

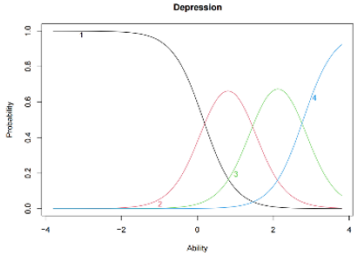

Fatigue
Probability
Ability


Appetite
Probability
Ability


Sleeping
Probability
Ability


Mobility
Probability
Ability


Daily activities
Probability
Ability


Depression
Probability
Ability

Strengths of CHROME-CVD

- **Content**
  - Patient-centered
  - Multi-stakeholders involvement
- **Methodology**
  - Extensive qualitative interviews
  - Large sample size
  - Rigorous methodologies
- **Comparability**
  - Core CVD-specific measure
  - Used across types of CVDs

Knowledge translation strategies

- Developing electronic and paper versions of CHROME-CVD;
- Developing policy briefs to inform policy makers;
- Conducting workshops on the content and user guide of CHROME-CVD;
- Improving the awareness of the CHROME-CVD among the public through social media.

Thank you!

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