



# Psychometric Evaluation of the Revised Collaboration for Leadership and Innovation in Mentoring Survey in a Diverse PhD Student Sample

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## INTRODUCTION

- Quality mentorship plays a significant role in successful PhD education.<sup>1,2</sup>
- Our Collaboration for Leadership and Innovation in Mentoring (CLIM) survey was previously validated among nursing PhD students.<sup>3</sup>
- The CLIM has not been evaluated using a large heterogeneous PhD student population.

## PURPOSE

- Re-evaluate the internal consistency reliability and structural validity of the CLIM survey.

## METHODS

### Design/Data Source

- Cross-sectional descriptive study
- Data collected from 819 current PhD students at a large public university (out of 5,539 - response rate 14.8%)
- Inclusion criteria: currently enrolled PhD students (Winter 2021), ages 18 years or older; not opted out of previous survey initiatives

### Measures

- CLIM consisting of 44 items scored on 6-point Likert Scale (12 items reverse coded)
- Demographics (sex, minority/citizenship status, candidacy stage, discipline, years with mentor)

### Statistical Analyses

#### Item Analysis

- Sample Characteristics**  
Demographics, response rates, listwise deletion for missing variables
- Item sensitivity**  
Per-item means, standard deviations, and ranges
- Intercorrelation**  
Polychoric item-item correlation matrix<sup>4</sup>
- Factorability**  
• Kaiser-Meyer-Olkin for sampling adequacy  
• Henze-Zirkler's and Mardia's tests for multivariate normality  
• Bartlett's test of sphericity

#### PCA<sup>5</sup>

- Initial 44-item survey**
- Principal axis factoring with promax rotation<sup>6</sup>**
- Preliminary factor structure evaluated**
  - % variance explained
  - Kaiser criterion: factors with eigenvalues >1.0
  - Scree plot and Horn's Parallel analysis<sup>7</sup>
  - Item/factor loading
- Reduced survey created (22-items)**
- Final factor structure evaluated**  
Compared to initial PCA results

#### Reliability

Cronbach's alpha

## RESULTS

### Sample Characteristics (N=819)

- 58.2% male, 60.9% White/US citizen
- 79.7% at candidacy stage
- 88.6% had dissertation chair as primary mentor
- 93.5% with their primary mentor for >1 year
- 95.7% receiving additional mentorship

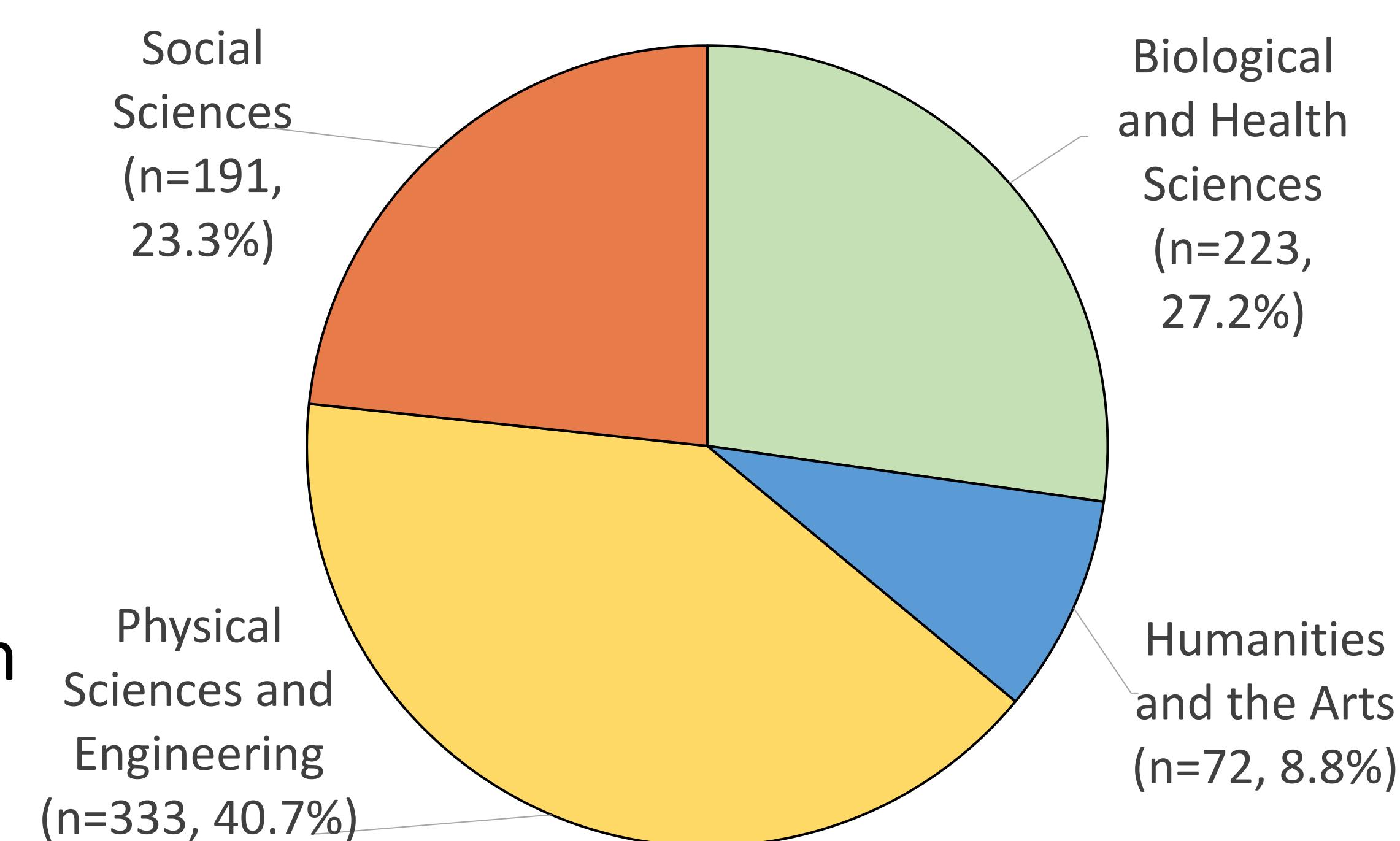
### CLIM-22 Characteristics

- Total score mean was 81.6 (SD=15.4) with a minimum score of 15 and maximum score of 110

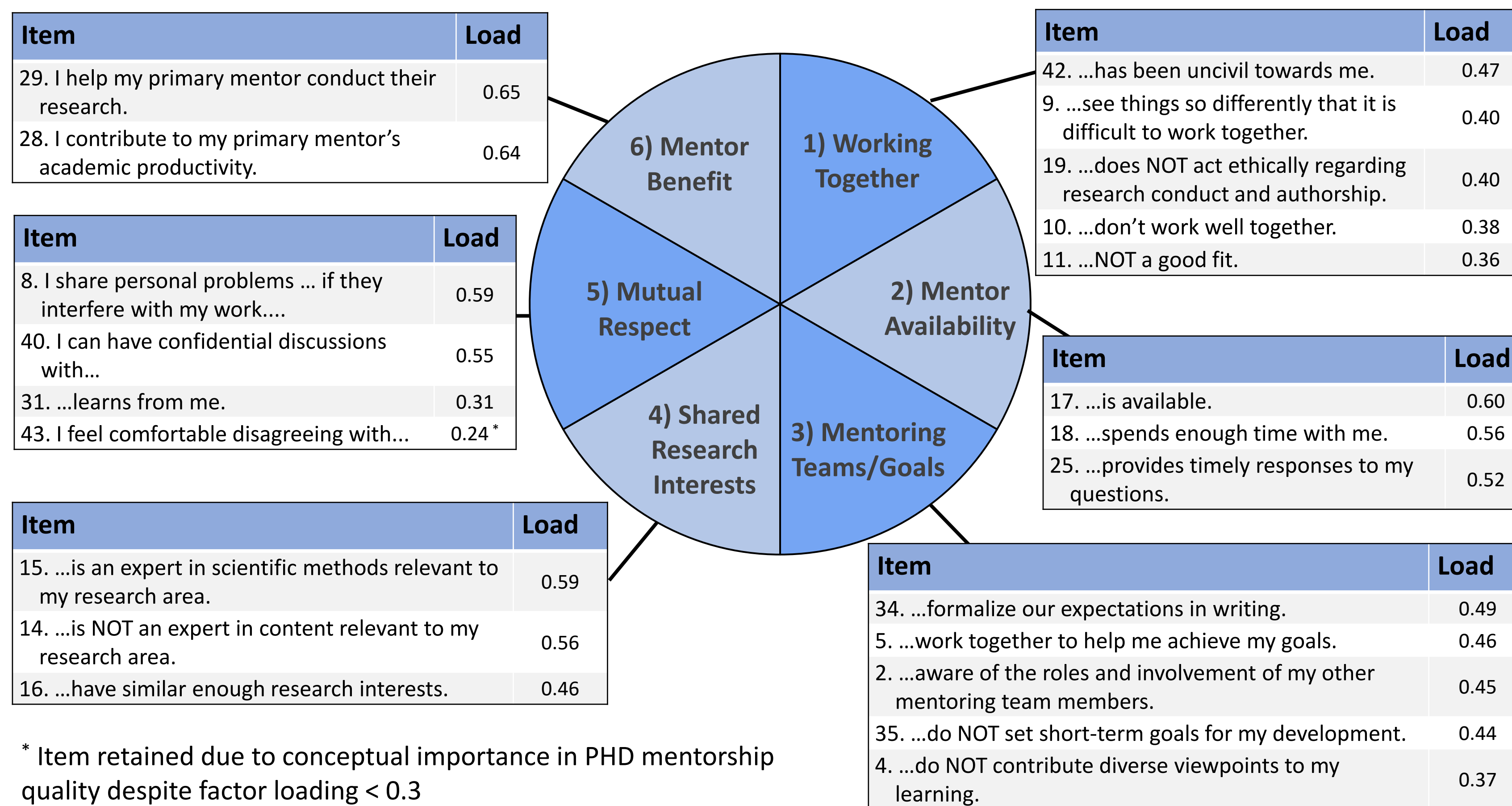
### Instrument Reduction

- First PCA reported 6 components with eigenvalues >1, cumulative variance explained 68.9%
- Horn's parallel analysis recommended a 5-factor solution
- 6 components retained, with 22 items loaded with component loadings >0.3
- Second PCA reported 6 components with eigenvalues >1, cumulative variance explained 72.1%
- Components named 1) Working together, 2) Mentor availability, 3) Mentoring teams and goals, 4) Shared research interests, 5) Mutual respect, and 6) Mentor benefit

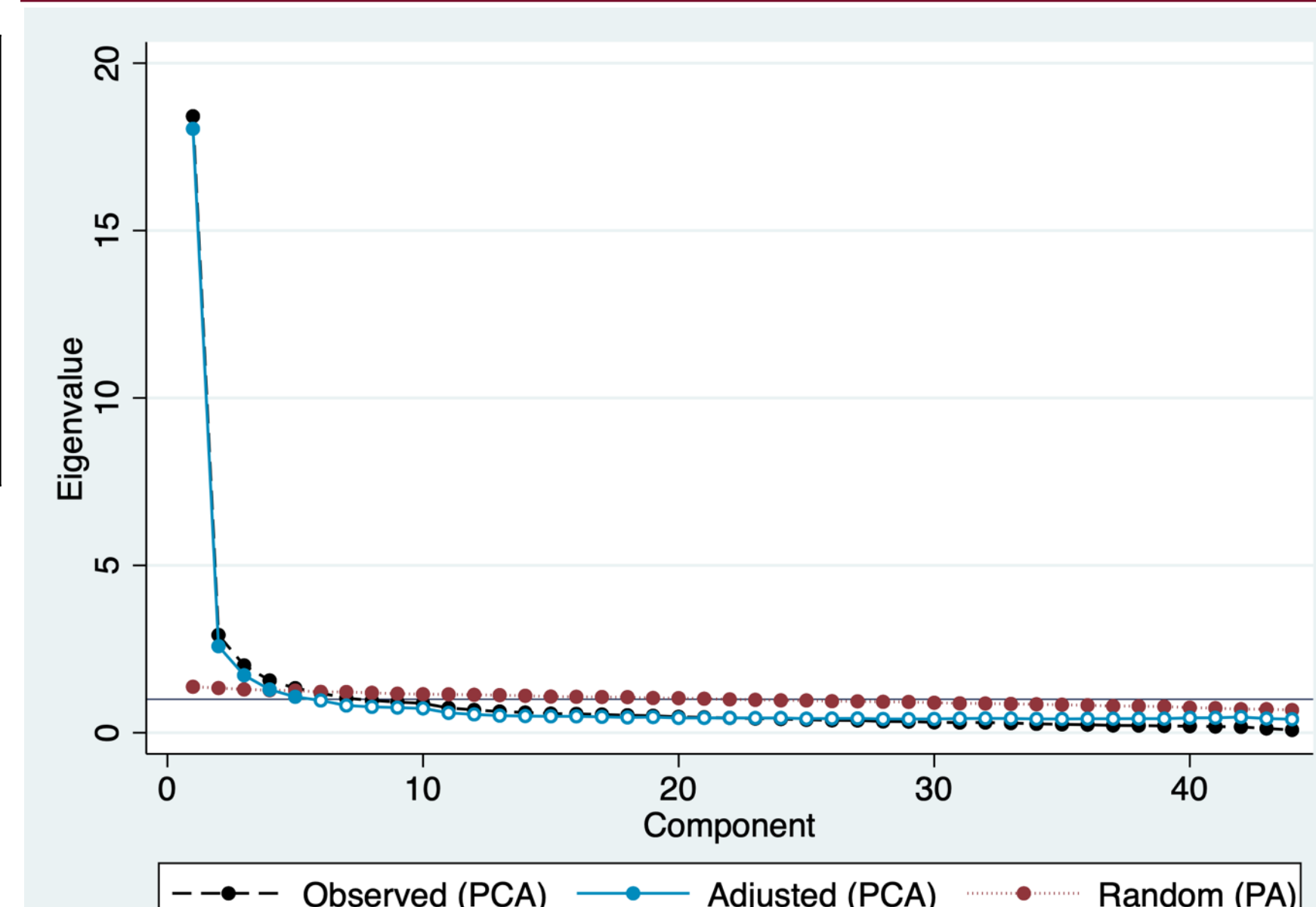
### PhD Program Distribution



### 22-Item CLIM and Factor Loadings



### Scree Plot with Horn's Parallel Analysis



Note: Of observed components, 5 have eigenvalues > those generated at random, 6 have eigenvalues > 1, and 5 components have adjusted eigenvalues >1. We decided to follow Kaiser's rule and retain 6 components due to the conceptual importance of the 6<sup>th</sup> component and because its adjusted eigenvalue (0.9646) was near the cutoff of 1.  
PCA= Principal component analysis; PA= Parallel analysis

### Reliability

- The Cronbach's alpha of for the total items on the reduced CLIM-22 scale was 0.89.
- Five of six components had Cronbach's alpha coefficients > 0.7, with one at 0.67 (Mutual Respect).

### Reliability

Factor	Items	Alpha	Range	M(SD)
1) Working together	9, 10, 11, 19, 42	0.89	0-25	20.81 (4.92)
2) Mentor availability	17, 18, 25	0.88	0-15	11.73 (3.33)
3) Mentoring teams and goals	2, 4, 5, 34, 35	0.70	0-25	16.37 (4.62)
4) Shared research interests	14, 15, 16	0.74	0-15	12.14 (2.88)
5) Mutual respect	8, 31, 40, 43	0.67	0-20	13.45 (3.81)
6) Mentor benefit	28, 29	0.85	0-10	7.07 (2.61)
<b>Total CLIM</b>	All 22 items	0.89	15-110	81.57 (15.42)

## DISCUSSION

- The reduced CLIM-22 provided evidence of validity and reliability and may capture mentorship quality across multiple diverse PhD programs.
- Limitations of this work include missing data, low response rates among the PhD student body, and a single institution study.
- Future research to evaluate cut-points and test-retest reliability is needed.

References and contact

