Developing a Common Metric for Substance Use Severity

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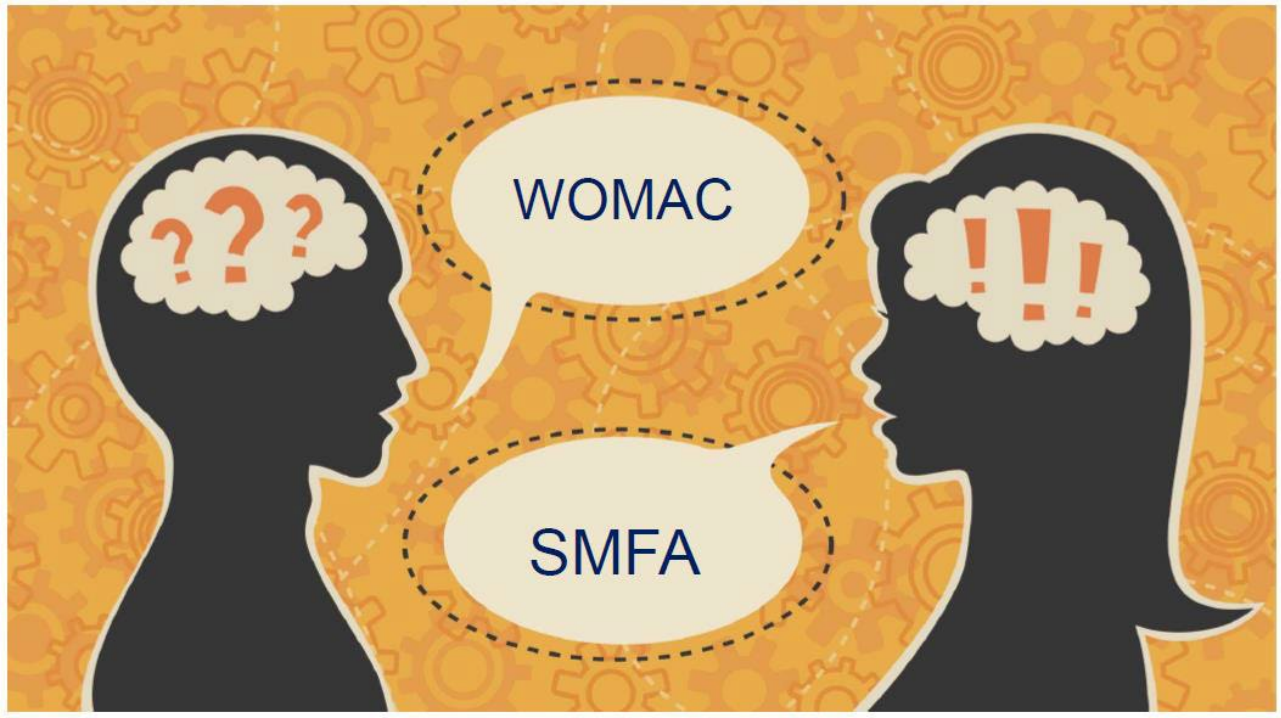


Research Context

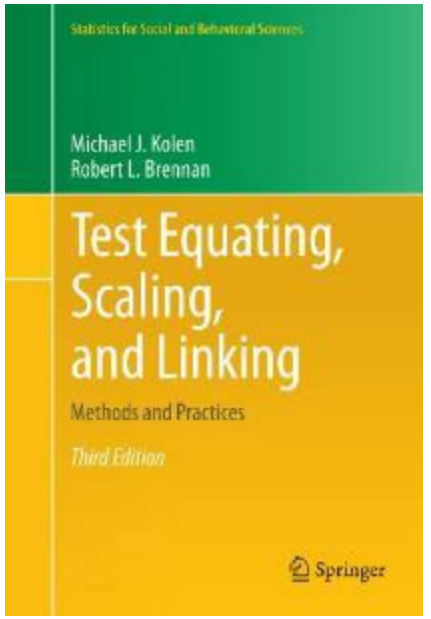
- Substance use plays a major role shaping the HIV epidemic (Jenkins, 2018; El-Bassel et al., 2014)
- Substance use can provide important information on HIV risk
- It can impede HIV+ treatment success (Malta et al., 2014; Reback et al., 2019)
- Reliable and valid measurement of substance use severity is necessary to determine risk and intervention

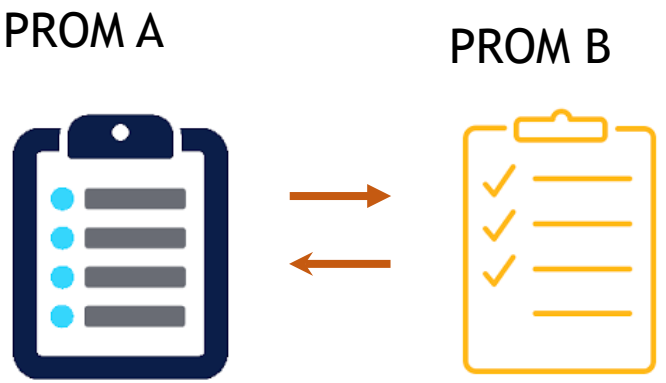
Research Context

- Valid and reliable self-reported assessments of substance use exist, but *multiple improvised* assessments proliferate
- Cross-study synthesis becomes complex
- Experts in questionnaire research have long documented that participant interpretations are influenced by wording (e.g., Streiner et al., 2014)
- Necessary to resolve such disharmony

Research Context

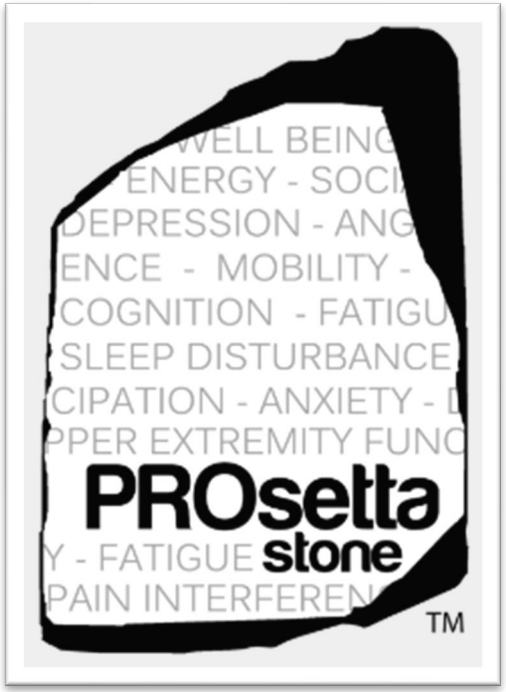
- One way to reduce the disharmony of multiple assessment is to conduct studies that “link” multiple instruments
- This allows scores to be exchanged between instruments, adjusting for wording, response options, length, time-frame
- Borrowed from educational testing (Kolen & Brennan, 2014).





Goals of the present study

- Link multiple generic substance use severity measures to one another via the PROMIS T-score metric
- Focus on the DAST and PROMIS Substance Use Severity
- Conduct a cross-sectional study of people who use substances, such that *each participant completes both measures*
- Follow methodology of PROsetta Stone project
- PROsetta package in R (Choi et al., 2021)



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Measures

- Patient-Reported Outcomes Measurement Information System (PROMIS®): Severity of Substance Use (SSU) (Pilkonis et al., 2015)
  - "My desire to use drugs seemed overpowering" and "Drugs were the only thing I could think about" [20 items, 5 answer options]
- The Drug Abuse Screen Test (DAST-10) (Skinner, 1982)
  - "Are you always able to stop using drugs when you want to?" and "Have you neglected your family because of drugs?" [10 items, 2 answer options]

Methodology

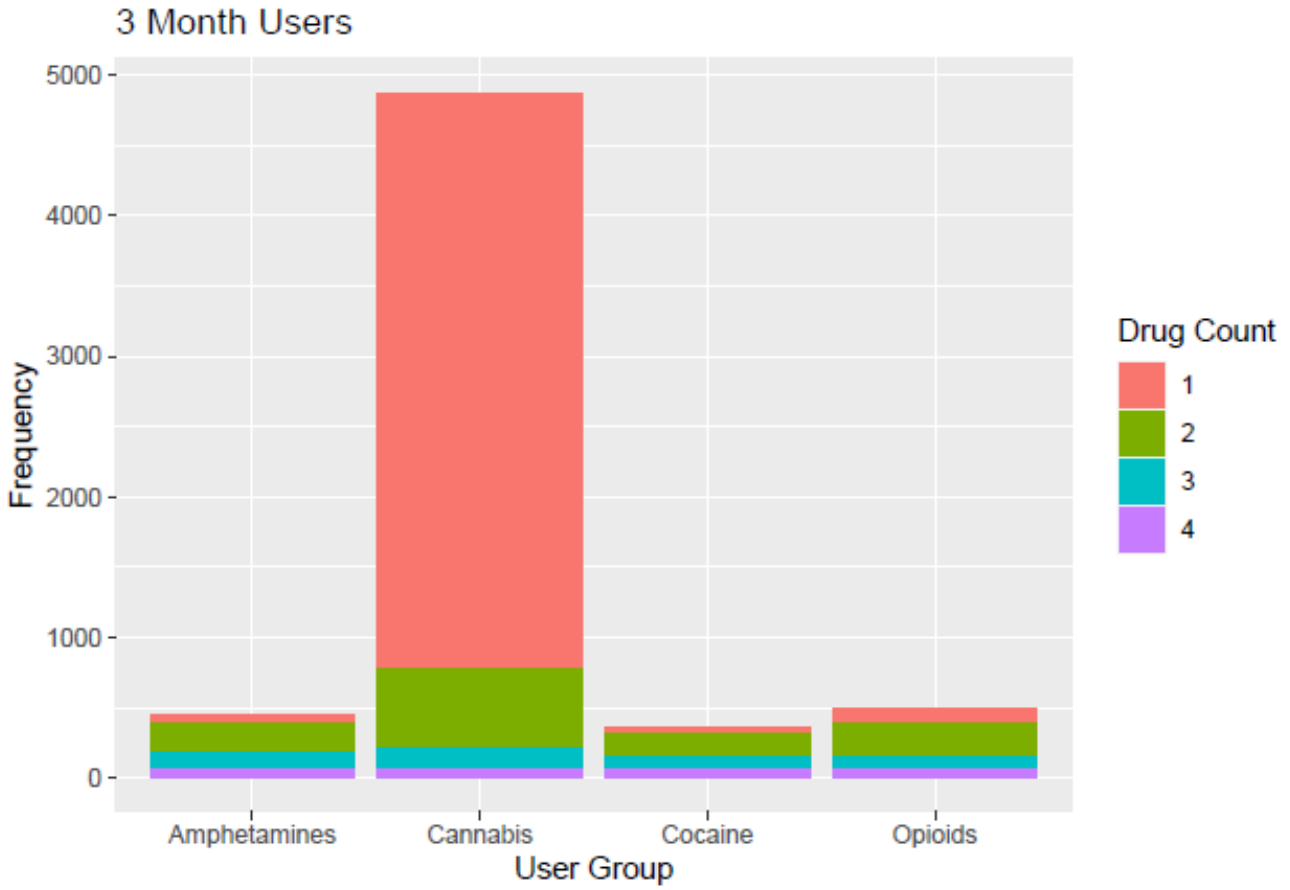
- YouGov collected 5,000 surveys from people who have used substances (cannabis, amphetamines, cocaine, and opioids) in the past 12 months
- Check assumptions for linking
  - Subpopulation invariance
  - Essential unidimensionality
- Conduct multiple linking methods, determine empirically which is best
- Fixed parameter calibration, stocking-lord linking, equipercentile linking, calibrated projection (Choi et al., 2014; Schalet et al., 2021)

Results: Demographics

Categories	Frequency/Mean
N = 5,253	
Age (mean (SD))	51.3 (15.7)
Gender identity(%)	
Man	2413 (46)
Woman	2724 (52)
Other	97 (2)
Ethnicity (%)	
Hispanic/Latino	379 (7.2)
Non-Hispanic/Latino	4741 (90.3)
NA	133 (2.5)
Race (%)	
White or Caucasian	4366 (83.1)
Black/African-American	433 (8.2)
Asian	87 (1.7)
American Indian/Alaska Native	77 (1.5)
Other	267 (5.1)
Education (%)	
High School degree or less	1115 (21.2)
Some college	1961 (37.3)
College degree	1351 (25.7)
Advanced degree	824 (15.7)

Results: Substance use groups

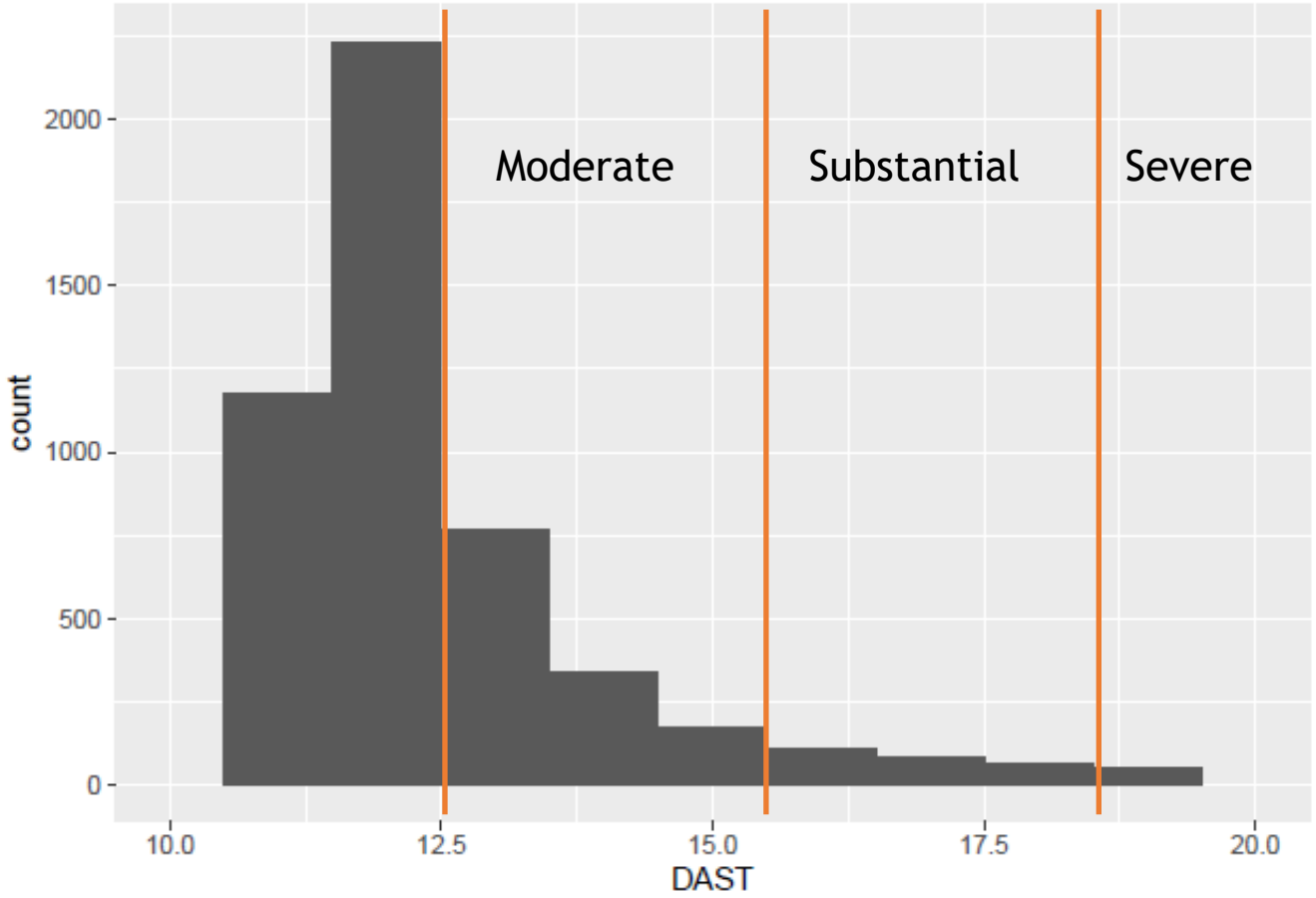
Group	N
All participants	5,253
Cannabis	4,912
Amphetamines	491
Cocaine	414
Opioids	516
Not cannabis only	1090



Results: Severity of substance use

- Total sample by DAST severity classifications

- ~3000 (very) low level
- ~1300 further investigation
- ~300 intensive assessment



Results: Severity of substance use

- Differences of at least 4 T-score points (1/2 SD) for cannabis vs other drug:

Group	N	PROMIS T-score	SD	PROMIS Item Score	SD
All participants	5,253	45.6	6.7	1.3	0.7
Cannabis	4,912	45.4	6.5	1.3	0.6
Amphetamines	491	53.8	7.1	2.2	1.2
Cocaine	414	53.4	7.4	2.3	1.2
Opioids	516	50.0	8.3	1.8	1.1

Results: Severity of substance

- Most 12-month users also used in the past 3 months:

Drug group	No	Yes	%Yes
Cannabis	80	4875	98
Amphetamines	42	453	92
Cocaine	61	360	86
Opioids	34	495	94

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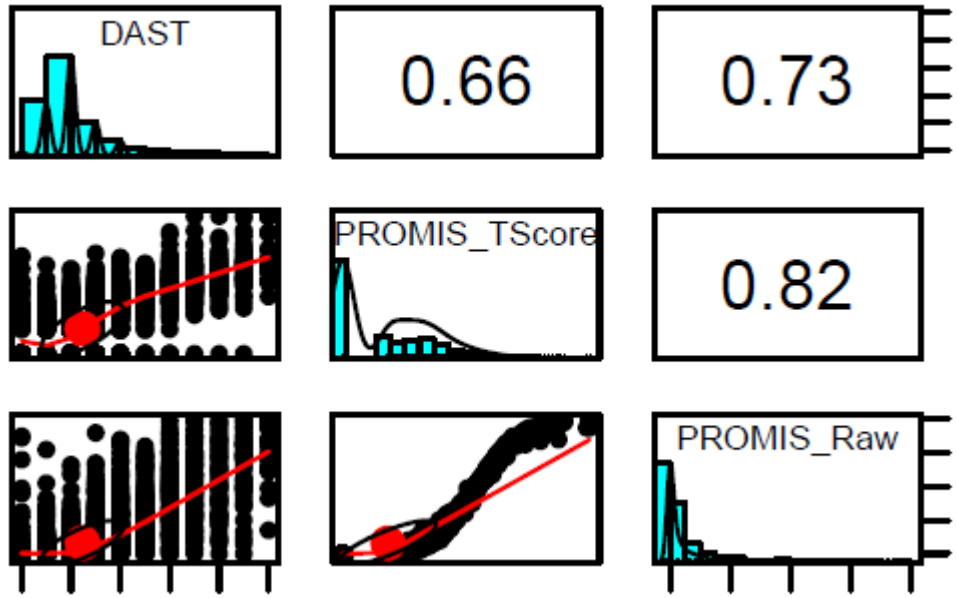
Linking assumptions: Unidimensionality

- CFA fit statistics supported both a single and two-factor model
- Raw score correlations between the raw scores were a bit on the low side (0.73)
- Linking proceeds on the assumption that cross-walk tables will be applied for *group use* (e.g., N > 50)



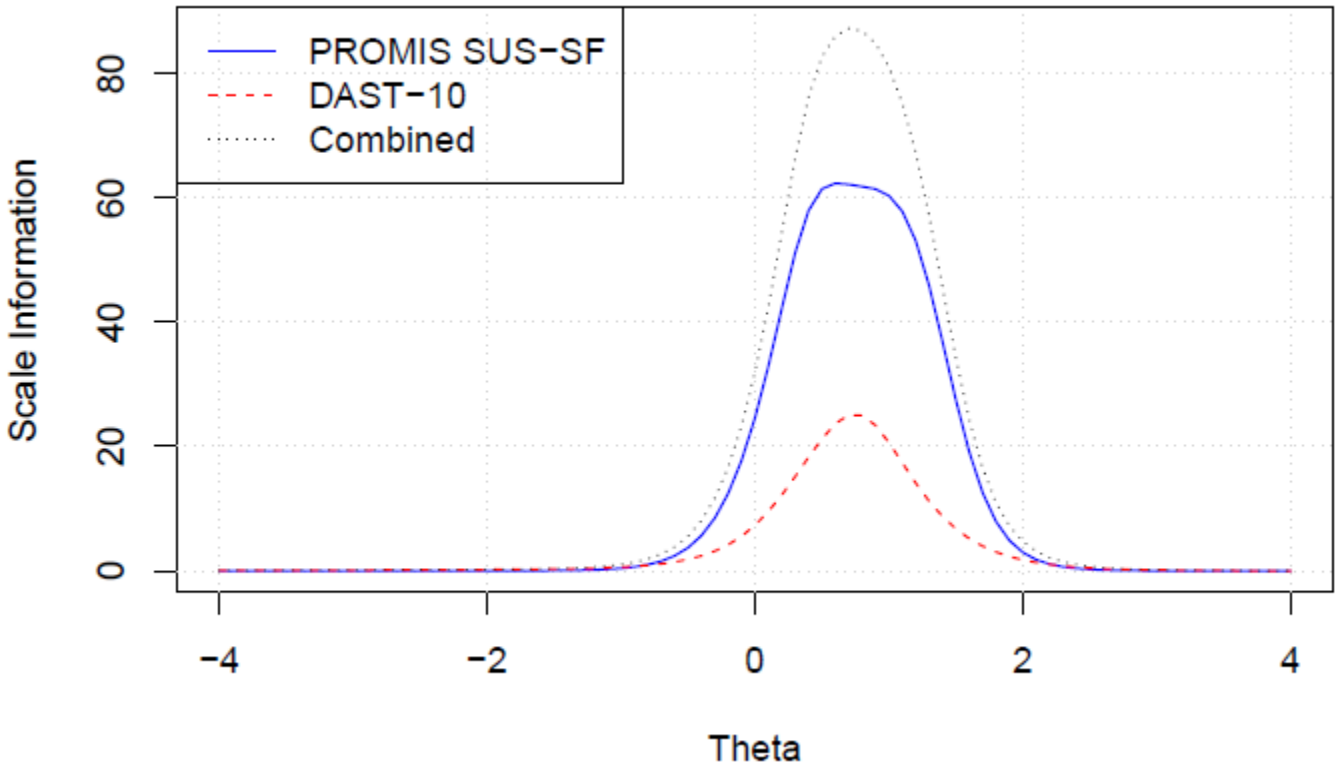
Linking assumptions: Subpopulation difference

- Standardized mean differences between subgroups are similar, whether DAST or PROMIS is used:

Subgroup	DAST Difference	PROMIS Difference
Male vs Female	0.13	0.11
<52 vs >52	0.50	0.50
Cannabis vs Others	-1.18	-0.98

Result : Item Response Theory Calibration

- Information from the fixed-item calibration shows both measures provide reliable assessment in the same range
- “Best” measurement when Theta = 0.5-1.5 (or T-score 55-65)
- 7-item PROMIS SF diplayed



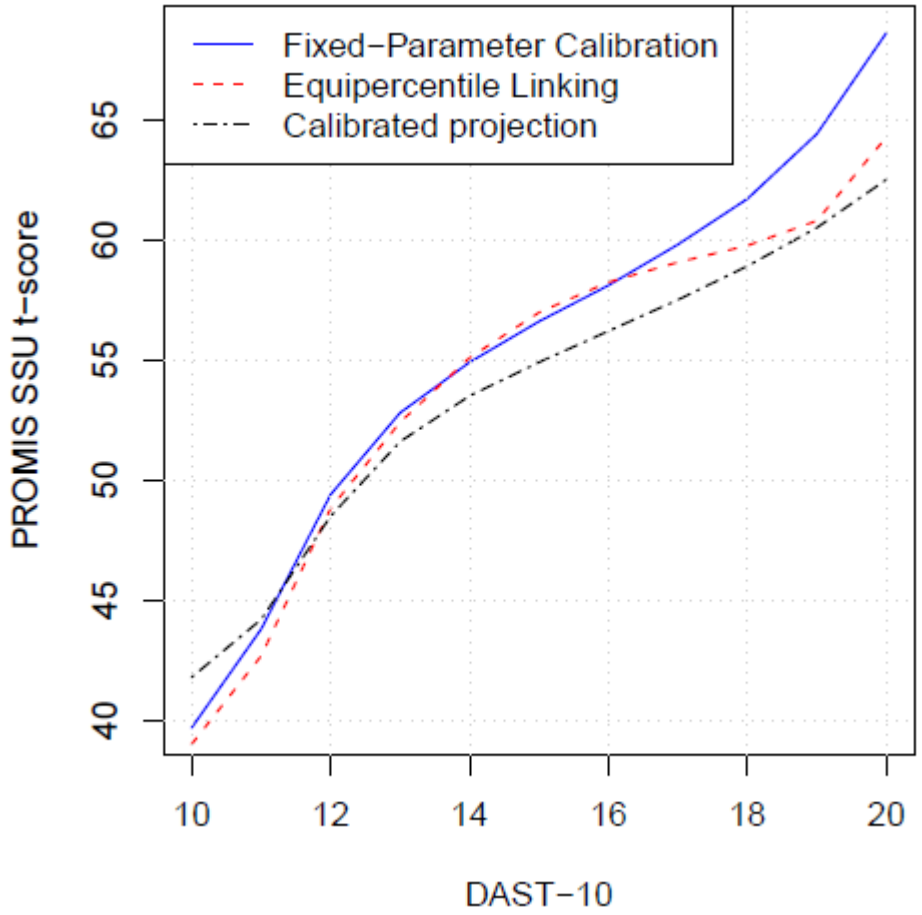
Result : DAST IRT parameters are reasonable

- Discrimination (a) is similar for 2 calibrations (2.9 vs 2.5)

	All participants (N = 5,253)		W/out cannabis-only users (N = 1,090)	
Item	**a**	**b**	**a**	**b**
DAST10_1	0.8	-1.3	1.0	-1.0
DAST10_2	1.8	0.5	1.2	-0.1
DAST10_3	2.4	0.9	2.2	0.9
DAST10_4	2.7	0.9	2.2	1.0
DAST10_5	4.0	0.4	3.3	0.3
DAST10_6	3.3	0.8	2.9	0.8
DAST10_7	4.9	0.8	4.1	0.8
DAST10_8	2.5	0.9	2.5	0.8
DAST10_9	3.6	0.6	2.6	0.5
DAST10_10	3.6	0.9	2.8	0.9

Result : Cross-walk table by method

- Fixed calibration and equipercentile are similar
- But difference with CP grows as substance use becomes more severe higher scores
- Result shown for 7-item PROMIS SF



Result : Compare methods with agreement

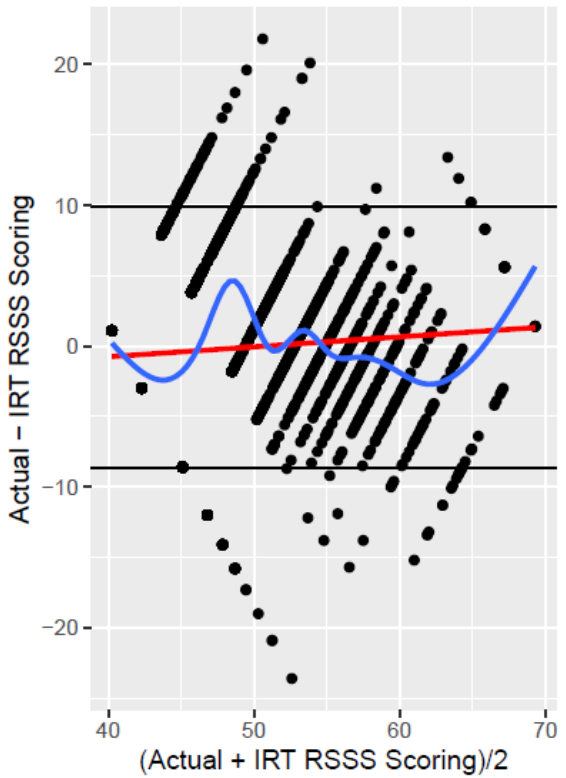
- Agreement: actual PROMIS T-scores vs those estimated by DAST

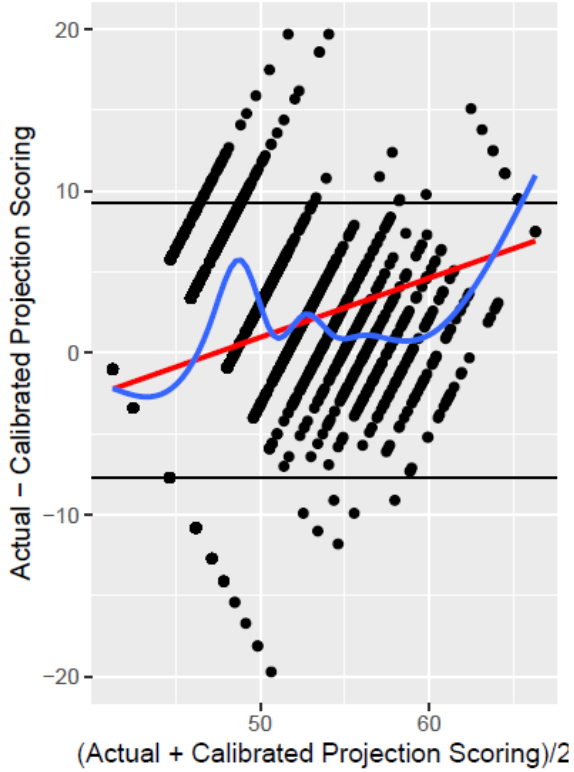
Method	r	Mean	SD	rmsd	mad
Fixed calibration (pattern scoring)	0.68	-0.27	4.96	4.97	3.77
Fixed calibration (cross-walk table)	0.67	-0.35	4.98	4.99	3.89
Equipercentile	0.67	0.49	5.01	5.03	3.80
Calibrated projection	0.68	-0.52	4.64	4.67	3.76

- Fixed calibration shows mean difference closest to zero, but CP minimizes sd/rmsd

Result : Bland-Altman Plots of Agreement

- CP shows lower limits of agreement
- FC shows better agreement for high scores
- No clear winner: choose for simplicity of fixed calibration





Result : Score cross-walk table

- Final score cross-walk table
- Can convert both directions

DAST	PROMIS T-score	DAST Classification
0	39.5	None
1	43.6	Low (> 43)
2	49.2	
3	52.6	Moderate (>52)
4	54.8	
5	56.5	
6	58.2	Substantial (>58)
7	59.9	
8	61.9	
9	64.7	Severe (>64)
10	68.8	

Summary

- Conducted study to link PROMIS and DAST, using methods developed in the PROsetta project
- Data from a large number substance users from internet panel
- Participants completed *multiple* substance use measures

- Assumptions were met to support linking
- Settled on fixed calibration (unidimensional) method
- Similar results were obtained when cannabis-only users were removed

Conclusions and next steps

- Results are available to assist with data harmonization efforts of substance use severity, centered on PROMIS metric
- Results seem to be robust relative to level of severity, but there are limits
- Need to validate results in additional samples
- Linking with PROMIS to continue for ASSIST Amphetamines, Cocaine, and Opioids…
- Plea: Methodological research is needed to understand the differences in linking methods


KEEP
CALM
AND
USE
PROMIS