

Background/Significance

- Solid organ transplant (SOT) recipients (specifically, liver [LTRs] and kidney [KTRs]) frequently experience significant anxiety symptoms, which are associated with impaired quality of life.
- Precise and efficient assessment, which includes using patient reported outcome measures (PROMs) may help better management of anxiety symptoms in SOT recipients.
- The Patient Reported Outcome Measure Information System anxiety item bank (PROMIS-A) administered as Computer Adaptive Test (CAT) is a precise and minimally burdensome tool that has been validated in several patient populations.
- PROMIS-A CAT is yet to be validated in patients with SOT.
- This study aims to assess the reliability and validity of the PROMIS-A CAT among patients with SOT.

Methods

- Cross sectional, convenience sample of adult kidney (249) or liver (144) transplant recipients.
- Participants completed the PROMIS-A CAT, Generalized Anxiety Disorder-7 (GAD-7), Edmonton Symptoms Assessment (ESAS), EQ-5D-5L, and 12-item Short Form Health Survey (SF-12) questionnaires.
- Socio-demographic and clinical data was collected from medical records.

PROMIS-A CAT
29 items assessing symptoms of anxiety. Includes emotional, cognitive, hyperarousal and somatic symptoms

GAD-7
Assesses for generalized anxiety disorder and the severity of anxiety symptoms.

EQ-5D--5L
5 items used to rate health in terms of mobility, self-care, usual activities, pain/discomfort and anxiety/depression.

ESAS
9 items screening for emotional and physical symptoms: pain, tiredness, drowsiness, nausea, lack of appetite, shortness of breath, depression, anxiety and wellbeing.

SF-12
12 items which yield a physical component score (PCS; physical functioning, role-physical, bodily pain, general health) and mental component score (MCS; vitality, social functioning, role-emotional, and mental health).

- Statistical Analyses**
 - Item-response theory for reliability of PROMIS-A CAT.
 - Cronbach's alpha for reliability of GAD-7.
 - Intraclass Correlations Coefficient (ICC) for test-retest reliability.
 - Spearman's rho for convergent validity.
 - Independent sample t-test and Mann-Whitney U test for known-group comparisons.
 - Receiver operating characteristic curve (ROC) analysis and Youden's J for discrimination.

Acknowledgments

This research is supported by the Kidney Foundation of Canada (KFOC190008) and the Canadian Institutes of Health Research (CIHR-PJT165915). An additional thanks to the research team and fellow investigators for their contribution.

Contact

Katalin Groe (katalin.groe@gmail.com)
Dr. Istvan Mucsi (istvan.mucsi@utoronto.ca)

Results

Table 1. Baseline characteristics of sample by solid organ replacement type

Characteristics	Total Cohort (393)	Kidney Transplant (249)	Liver Transplant (144)	P Value
Age (SD)	53 (14)	54 (13)	53 (15)	P= 0.799
Sex [N (%) Male]	235 (60%)	141 (57%)	94 (65%)	P= 0.092
Marital Status				
Single	65 (19%)	35 (17%)	30 (21%)	P= 0.535
Married/Common Law	236 (68%)	144 (69%)	92 (66%)	
Divorce/Separated/Widowed	48 (14%)	30 (14%)	18 (13%)	
Racialized status N (%)				
White	242 (64%)	134 (57%)	107 (76%)	P< 0.001
Asian	75 (20%)	57 (24%)	18 (13%)	
Black	28 (7%)	25 (11%)	3 (2%)	
Other	31 (8%)	19 (8%)	12 (9%)	
OMI Deprivation (%)				
Low Deprivation	150 (40%)	92 (38%)	58 (43%)	P= 0.671
Moderate Deprivation	85 (23%)	56 (23%)	30 (22%)	
High Deprivation	139 (37%)	92 (38%)	47 (35%)	
Median years since transplant (IQR)		2.9 (0.1-12.2)	2.1 (0.1-8.5)	
CCI N (%)				
< 4	267 (73%)	184 (80%)	83 (62%)	P< 0.001
≥ 4	97 (27%)	47 (20%)	50 (38%)	
Anxiety (N [%]) (GAD-7 score ≥ 10)	70 (18%)	35 (14%)	35 (24%)	P= 0.011
Depression (N[%])(PROMIS-D ≥ 60)	48 (14%)	23 (11%)	25 (17%)	P= 0.099

Abbreviations: SD: Standard Deviation; OMI: Ontario Marginalized Index; CCI: Charlson Comorbidity Index; IQR: Inter-quartile range; GAD-7: Generalized Anxiety Disorder-7; PROMIS-D: Patient Reported Outcomes Measurement Information System Depression Item Bank

Intraclass Correlation Coefficient: 126 patients completed the retest questionnaire within 14 days of the first questionnaire. Very good test-retest reliability with an ICC coefficient of 0.85 (CI: 0.81, 0.88).

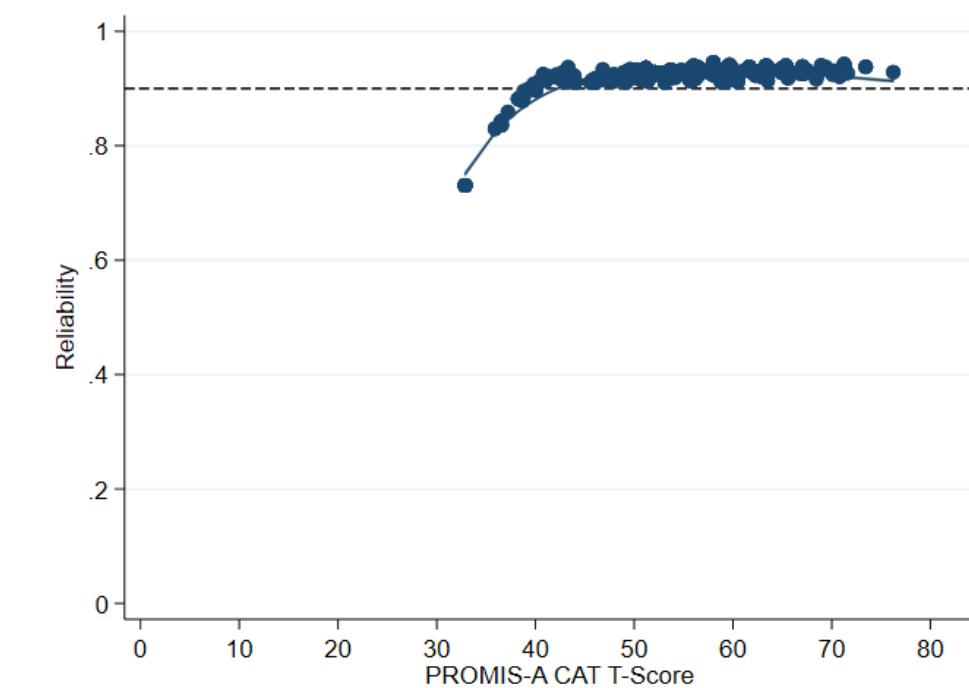


Figure 1. Reliability plot showing measurement precisions (standard error of measurement (SEM)) across PROMIS-A CAT scores among patients with solid organ transplant. The average reliability of the PROMIS-A CAT was very good at 0.92. 93% of participants had T-score over 40 and a reliability of ≥ 0.9.

Table 2. Known Groups Comparisons

Known Group	Group	n	PROMIS-A CAT			GAD-7		
			MEAN (SD) PROMIS-A T-score	Cohen's d (95% CI)	P-Value	Mean (SD) GAD-7	Cohen's d (95% CI)	P-Value
Sex	Male	85	51 (10)	-0.34 (-0.55, -0.14)	P<0.01	3 (6)	-0.08 (-0.28, 0.12)	P=0.16
	Female	56	55 (8)			4 (5)		
Education	< 12 years	43	54 (9)	0.04 (-0.18, 0.26)	P=0.20	4 (6)	0.16 (-0.09, 0.40)	P=0.20
	> 12 years	98	53 (9)			3 (5)		
CCI Score	< 5	12	52 (9)	-0.08 (-0.38, 0.21)	P=0.17	3 (5)	-0.19 (-0.52, 0.14)	P=0.20
	≥ 5	20	54 (9)			4 (6)		
Albumin	< 40	24	53 (9)	0.47 (0.25, 0.69)	P=0.79	2 (6)	0.39 (0.16, 0.62)	P=0.34
	≥ 40	11	52 (9)			3 (5)		
Hemo-globin	< 110	14	55 (9)	0.47 (0.85, 0.85)	P=0.05	4 (5)	0.46 (0.06, 0.86)	P=0.26
	≥ 110	12	52 (9)			3 (5)		
eGFR	< 30	98	53	-0.20 (-0.42, -0.01)	P=0.39	3 (5)	-0.18 (-0.40, -0.04)	P=0.79
	≥ 30	43	51			3 (6)		
SDI-Money Matters	< 2	92	51 (8)	-0.82 (-1.03, -0.61)	P<0.01	2 (4)	-0.74 (-0.96, -0.51)	P<0.01
	≥ 2	49	55 (8)			5 (6)		
PROMIS-D	< 60	12	52 (8)	-1.38 (-1.70, -1.06)	P<0.01	3 (4)	-1.57 (-2.02, -1.11)	P<0.01
	≥ 60	12	58 (7)			11 (6)		
PROMIS-SF	< 40	12	54 (8)	1.20 (0.87, 1.52)	P<0.01	4 (5)	0.65 (0.44, 0.87)	P=0.12
	≥ 40	15	44 (8)			2 (3)		

Abbreviations: GAD-7: Generalized Anxiety Disorder-7; PROMIS: Patient Reported Outcomes Measurement Information System; CAT: Computer Adaptive Test; CCI: Charlson Comorbidity Index; eGFR: estimated Glomerular Filtration Rate; SDI: Social Difficulties Inventory; SF: Social Function; D: Depression Item Bank

Table 3. Threshold Analysis of PROMIS-A T Scores against GAD-7 score ≥ 10

Cut-off	Sensitivity	Specificity	TP	TN	FP	FN	PPV	NPV	Youden's J
≥ 53	95.71	51.39	67	166	157	3	0.30	0.98	0.41
≥ 54	94.29	54.80	66	177	146	4	0.31	0.98	0.49
≥ 55	94.29	61.92	66	200	128	4	0.35	0.98	0.56
≥ 56	94.29	62.54	66	202	121	4	0.35	0.98	0.57
≥ 57	88.57	70.90	62	229	94	8	0.40	0.97	0.59
≥ 58	88.57	71.21	62	230	93	8	0.40	0.97	0.60
≥ 59	84.29	78.33	59	253	70	11	0.46	0.96	0.63
≥ 60	80.00	79.57	56	257	66	14	0.46	0.95	0.60
≥ 61	77.14	84.21	54	272	51	16	0.51	0.94	0.61
≥ 62	70.00	86.07	49	278	46	21	0.52	0.93	0.56

Abbreviations: GAD-7: Generalized Anxiety Disorder-7; PROMIS: Patient Reported Outcomes Measurement Information System; CAT: Computer Adaptive Test; TP: True Positive; TN: True Negative; FP: False Positive; FN: False Negative; PPV: Positive Predictive Value; NPV: Negative Predictive Value

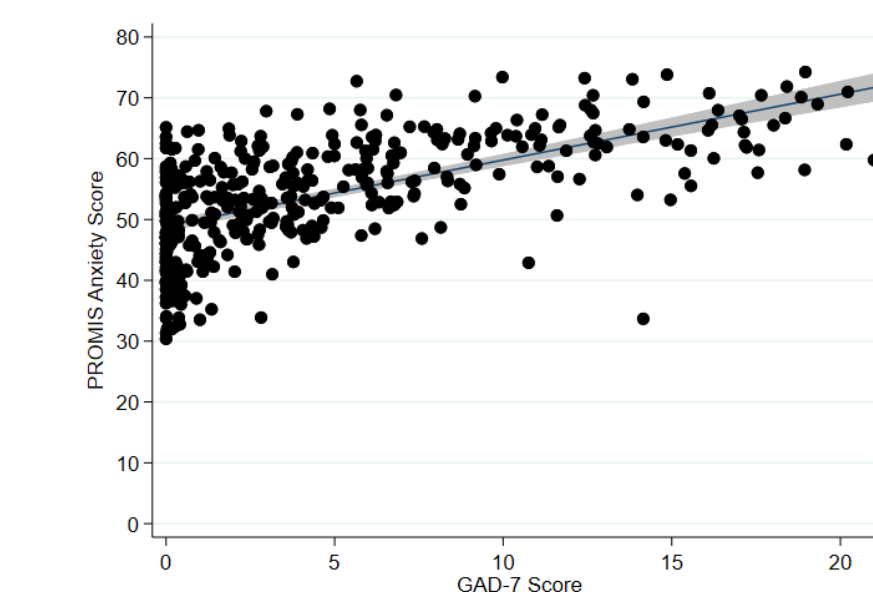


Figure 2. Scatterplot and linear fit between PROMIS-A CAT and GAD-7. A strong correlation was observed between PROMIS-A CAT and GAD-7 scores (r=0.67, 95% CI: 0.62 - 0.72).

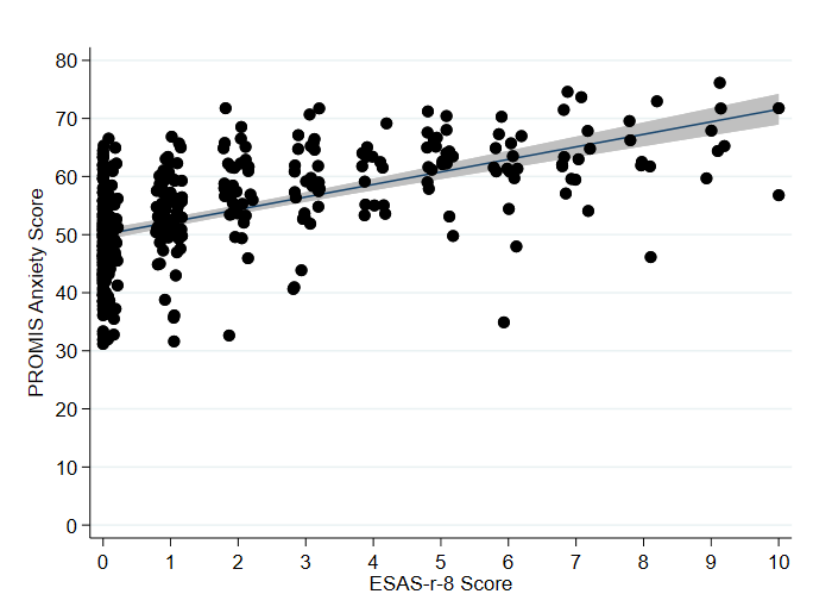


Figure 3. Scatterplot and linear fit between PROMIS-A CAT and ESASr. A strong correlation was observed between PROMIS-A CAT and ESASr scores (r=0.62, 95% CI: 0.55 - 0.68).

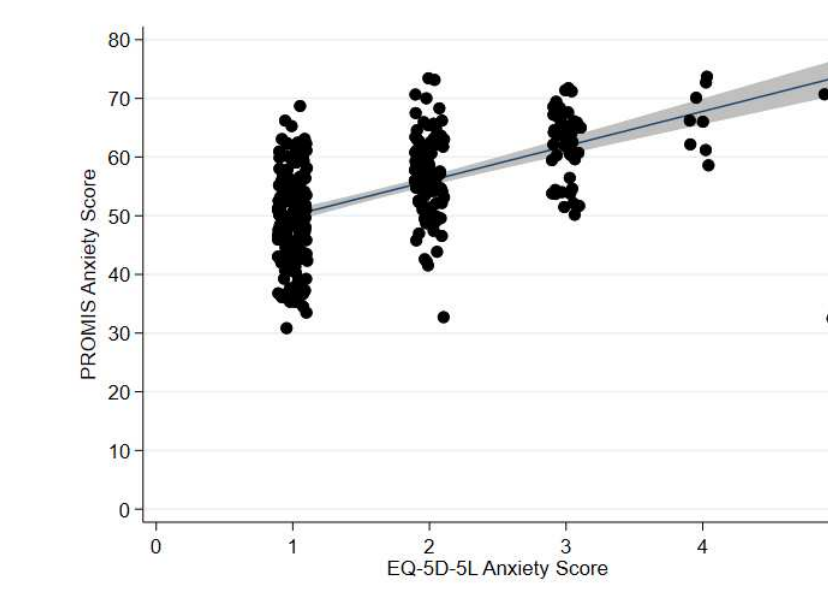


Figure 4. Scatterplot and linear fit between PROMIS-A CAT and EQ-5D-5L. A strong correlation was observed between PROMIS-A CAT and EQ-5D-5L scores (r=0.63, 95% CI: 0.56 - 0.69).

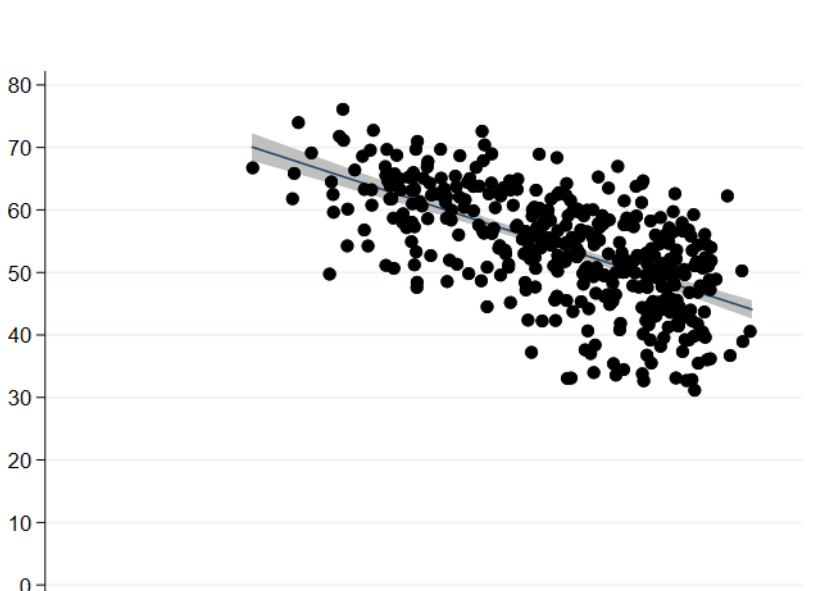


Figure 5. Scatterplot and linear fit between PROMIS-A CAT and SF-12 MCS. A strong correlation was observed between PROMIS-A CAT and SF-12 MCS scores (r=0.63, 95% CI: -0.68 - -0.56).

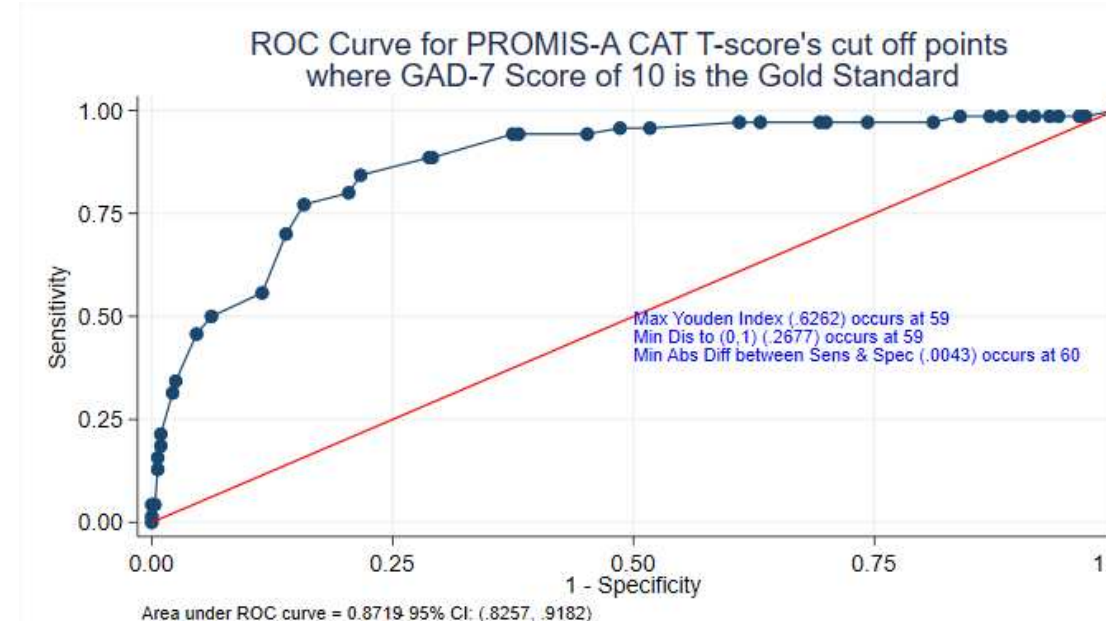


Figure 6. Receiver operating characteristics curve of PROMIS-A CAT T scores using a GAD-7 score ≥10 as a reference to define moderate/severe anxiety. The area under the curve (AUROC: 0.87 [95% CI: 0.83-0.92]) demonstrated excellent discrimination.

Discussion

- Our results support the PROMIS-A CATs reliability and construct validity in assessing anxiety symptoms in KTRs and LTRs
- The PROMIS-A CAT demonstrates good reliability; it is precise over a broad range of anxiety levels
- Strong correlations with legacy measures and the known group comparisons support the construct validity of the PROMIS-A CAT
- These results are consistent with previous studies examining the reliability and validity of PROMIS CATs among other clinical populations

Conclusions/Implications

- Our findings provide new information on the psychometric properties of the PROMIS-A CAT among KTRs and LTRs
- Future studies should evaluate the use of the PROMIS-A CAT to inform the management of anxiety symptoms among SOT recipients

References

- O'Reilly, F., et al., Baseline Quality of Life and Anxiety in Solid Organ Transplant Recipients: A Pilot Study. Dermatol. Surg., 2006. 32: p. 1480-1485.
- Cella, D., et al., The Patient-Reported Outcomes Measurement Information System (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005-2008. J Clin Epidemiol, 2010. 63(11): p. 1179-94.