The Hope Network Acuity Scale (HAS):

Development, Validation And Utility Of A Neuro Rehabilitation Acuity Measure

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Introduction

Required caregiver effort in neurological rehabilitation encompasses both demands for caregiving needs and protective supervision supports. To quantify this dimension of care, the Hope Network Acuity Scale (HAS) was developed. This study provides a preliminary analysis of the psychometric properties of the HAS, an eight item two-factor (behavioral and medical) scale designed to measure demand on caregiver effort in post-acute brain injury and neurological rehabilitation settings. The HAS quantifies important information that can potentially facilitate staffing, supervision and placement decisions and serve as a relevant functional outcome measure.

Hope Network Acuity Scale (HAS) Development

Objectives

- Meaningful for staffing and workload determination
- Clinically descriptive of the burden of care
- Efficiently administered by line supervisory staff
- Generalizable within Hope Network (Neurobehavioral, Transitional Post-acute, Long term care, Community treatment)
- Applicable to acute care as an admission screening tool
- Sensitive to the nuances of post-acute rehab care
- Functional as an outcome measure
- Robust for research and transferable to other settings (acute care, IRF, home based care)

Development of the HAS Beta Version

- Literature Search
- Peer programs
  - Reviewed proprietary scales for local use (generally not validated or evaluated for reliability)
- Initial priorities
  - Two factor measure equal part medical and neurobehavioral
  - Ascending scale of acuity (high numbers = high acuity)
  - Suited to the post-acute environment
  - Emphasizing the experience of the direct caregiver
  - Ratings by supervisory caregiver staff at the shift level
  - Clear language at the direct care level
  - Capture attendant and supervisory care needs

HAS Interrater Reliability Trial

208 Acuity Scale ratings on 104 consumers were performed

- Each consumer had two completed ratings performed on the same day by staff members familiar with the consumer; one by the Residential Supervisor (“designated rater” or A) and one by another (“non-designated rater” or B) staff member.

- B raters:
  - Shift Lead (86.5%)
  - Rehabilitation Technician (5.8%)
  - Nurse (2%)
  - Other staff member (5.8%)

- A one-way random Intraclass correlation (ICC) is calculated for reliability. This particular ICC is used because there are potentially two different raters for each participant. It is the most conservative ICC.

Interrater Reliability: (Descriptive Statistics A/B Scores)

Interrater Reliability Trial Descriptive Statistics					
	N	Min	Max	Mean	SD
Rater A Total	104	.00	23.00	7.80	5.73
Rater A Behavioral	104	.00	12.00	3.83	2.84
Rater A Medical	104	.00	12.00	3.97	3.61
Rater B Total	104	.00	23.00	8.16	5.70
Rater B Behavioral	104	.00	12.00	4.17	3.03
Rater B Medical	104	.00	12.00	3.99	3.55
Valid N (list wise)	104				

RESULTS: IRR Interclass Correlation Data

Medical Subscale	.94 (95% CI .92 -.96)
Behavioral Subscale	.90 (95% CI .86 -.93)
Total Scale	.95 (95% CI .93 -.97)

** 1-way random ICC*

IRR Interclass Correlation Data

Table 2. Intraclass Correlation Coefficient – Acuity Total							
	Intraclass Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.952	.930	.967	40.44	103	104	.000
One-way random effects model where people effects are random.							

Table 2. Intraclass Correlation Coefficient – Medical Acuity Total							
	Intraclass Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.943	.917	.961	34.037	103	104	.000
One-way random effects model where people effects are random.							

Table 4. Intraclass Correlation Coefficient – Behavioral Acuity Subscale							
	Intraclass Correlation	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.902	.859	.933	19.437	103	104	.000
One-way random effects model where people effects are random.							

Dataset Descriptive Statistics

- **Full Dataset** (Transitional initial scores and long-term residents) (Used for inter-item correlations and factor analyses)
  - N = 240
  - Mean age = 48.0 (SD = 15.06; Range = 18 – 87)
  - 66.7 % Male

- **Transitional Dataset** (Used for outcome and correlational analyses)
  - N = 105
  - Mean age = 46.9 (SD = 16.54; Range 18- 87)
  - 61% Male
  - Ave LOS 76.7 days (SD = 67.46, range = 11 -375)

Item Scores: Full Sample Descriptive Statistics

	N	Min	Max	Mean	SD	Skew	Kurtosis
ADLs/Transfers	240	0.00	3.00	1.32	1.07	0.32	-1.12
Mobility/Orthotics	240	0.00	3.00	1.14	1.07	0.44	-1.09
Skilled Medical Care	240	0.00	3.00	1.39	1.26	0.16	-1.62
Bowel/Bladder	240	0.00	3.00	1.02	1.16	0.69	-1.05
Fall Risk	240	0.00	3.00	1.38	1.02	0.20	-1.07
Aggression	240	0.00	3.00	0.76	0.87	0.95	0.07
Confused Behavior	237	0.00	3.00	1.11	0.99	0.34	-1.05
Precautions	240	0.00	3.00	1.05	1.15	0.42	-1.43
Medical Total	240	0.00	12.00	4.87	3.76	0.45	-0.90
Behavioral Total	240	0.00	12.00	4.27	2.94	0.48	-0.56
Acuity Total	240	0.00	24.00	9.14	5.91	0.41	-0.68

Construct Validity: Corrected Item – Total Correlations for Subscale Items

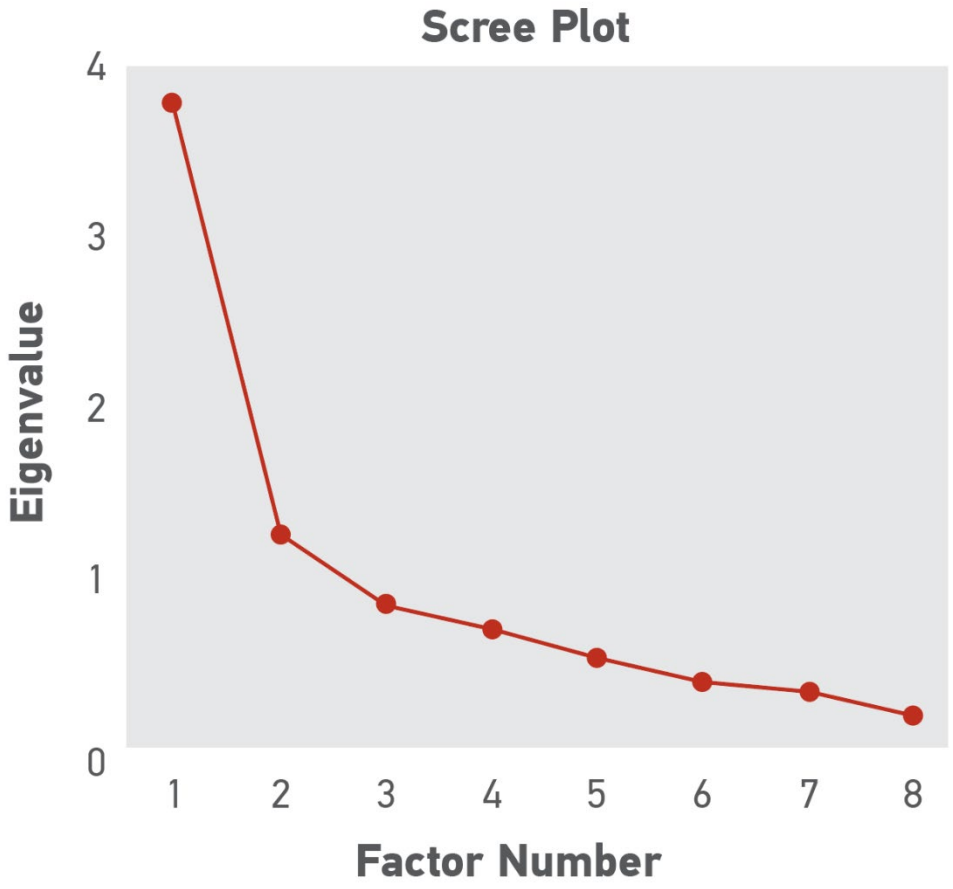
Medical Acuity: α = .84		
	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
ADLs/Transfers	.79	.75
Mobility/Orthotics	.71	.79
Skilled Medical Care	.55	.87
Bowel/Bladder	.70	.79

Behavioral Acuity: α = .70		
	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Fall Risk	.48	.65
Aggression	.30	.74
Confused Behavior	.60	.57
Precautions	.59	.57

EFA: Total Variance Explained

Factor	Eigenvalue	% of Variance	Cumulative Variance %
1	3.89	48.58	48.58
2	1.15	14.39	62.97
3	0.86	10.69	73.66
4	0.63	7.88	81.54
5	0.55	6.87	88.41
6	0.37	4.56	92.97
7	0.34	4.20	97.17
8	0.23	2.83	100.00

RESULTS: Construct Validity (EFA)



Pattern Matrix	Factor	
	1	2
ADLs/Transfers	.980	
Mobility/Orthotics	.740	
Skilled Medical Care	.595	
Bowel/Bladder	.732	
Fall Risk		.512
Aggression		.395
Confused Behavior		.790
Precautions		.607

Extraction Method: Maximum Likelihood.
Rotation Method: Oblimin with Kaiser.

Concurrent Validity: Spearman's Rho: HAS and SRS

Admission			
	Acuity Total	Medical Subscale	Behavioral Subscale
SRS Rating	.525**	.260**	.638**
Discharge			
	Acuity Total	Medical Subscale	Behavioral Subscale
SRS Rating	.662**	.536**	.610**

**p< .01

Concurrent Validity: Pearson Correlations: HAS and MPAI

Admission			
	Acuity Total	Medical Subscale	Behavioral Subscale
MPAI Total Score	.799**	.638**	.739**
MPAI Abilities Score	.701**	.596**	.606**
MPAI Adjustment Score	.705**	.517**	.704**
MPAI Participation Score	.787**	.672**	.676**
Discharge			
	Acuity Total	Medical Subscale	Behavioral Subscale
MPAI Total Score	.813**	.680**	.768**
MPAI Abilities Score	.765**	.691**	.668**
MPAI Adjustment Score	.714**	.532**	.742**
MPAI Participation Score	.814**	.706**	.741**

**p< .01

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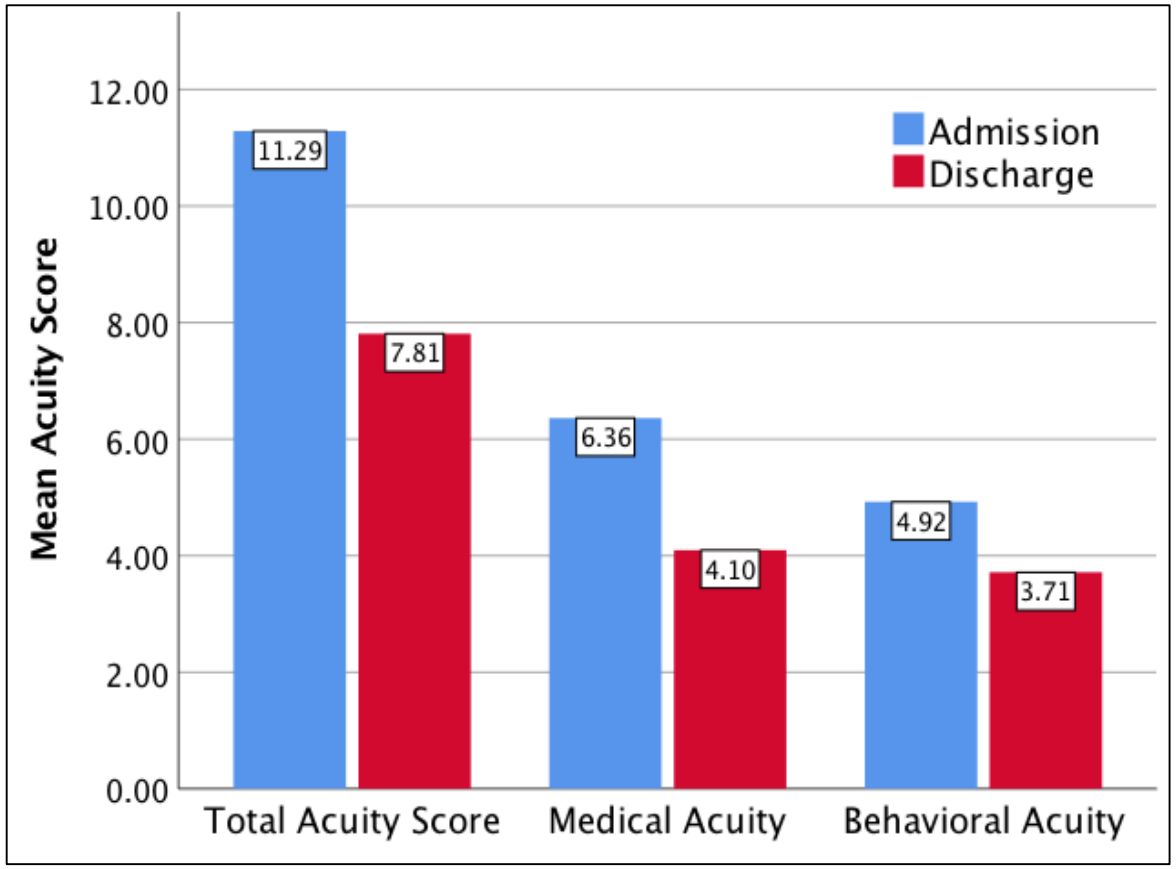
Discriminate Validity/Sensitivity to change Treatment Efficacy: Admission and Discharge HAS Scores



* All t-test(101) Significant comparisons p<.001

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HAS Discharge Scores by Discharge Placements (N>=7)

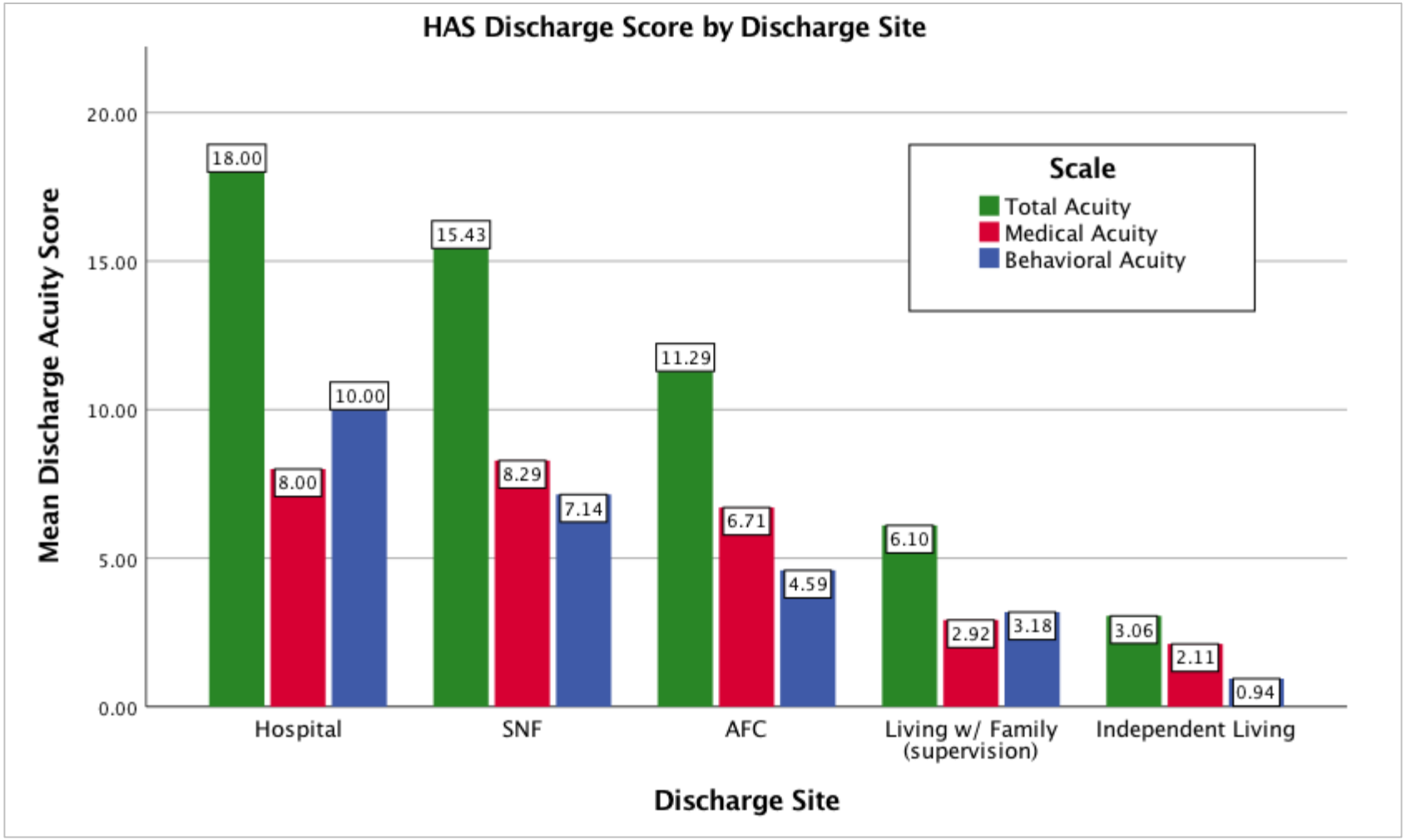

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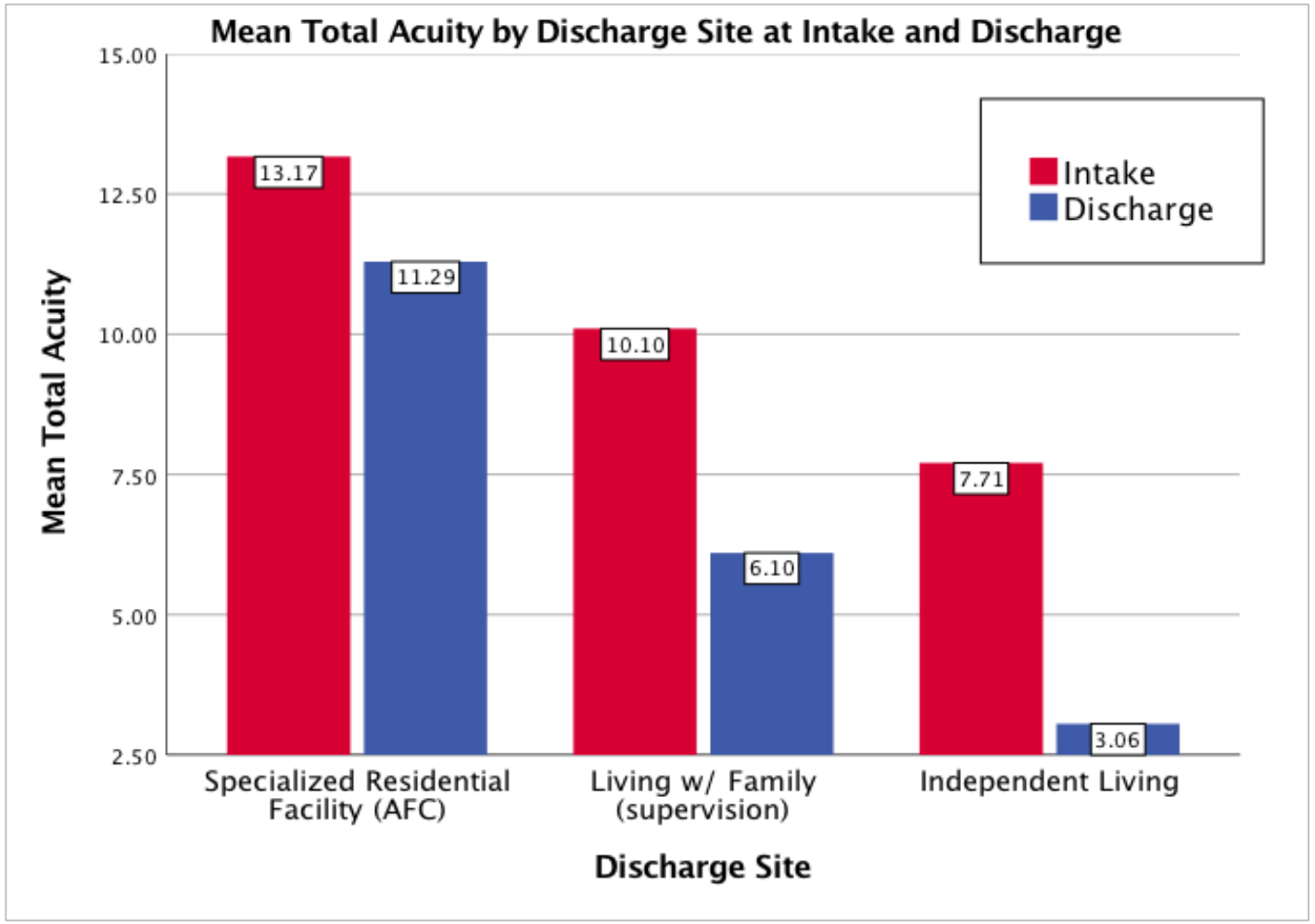
Table X. Descriptives: Discharge HAS Scores by Discharge Location

		Total Acuity		Medical Acuity		Behavioral Acuity	
	N	Mean	SD	Mean	SD	Mean	SD
Hospital	7	18.00	3.87	8.00	2.16	10.00	2.38
SNF	7	15.43	5.53	8.29	3.55	7.14	3.39
AFC	17	11.29	4.31	6.71	3.12	4.59	2.48
Supported Living	5	6.20	4.44	4.25	5.44	2.75	1.50
Living w/ Family (supervision)	49	6.10	4.73	2.92	2.90	3.18	2.86
Independent Living	18	3.06	2.15	2.12	1.67	1.06	1.00/
Other	2	4.50	0.71	1.50	0.71	3.00	0.00

HAS Scores at Admission and Discharge by Discharge Placement



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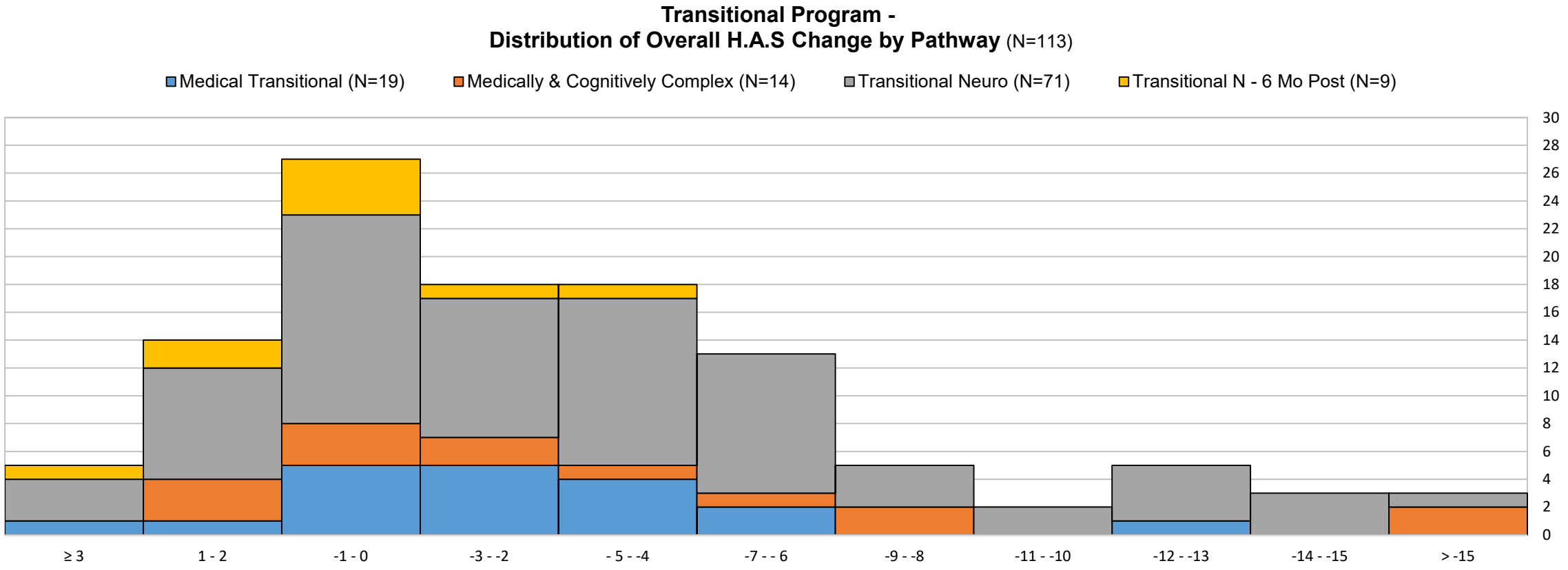
Discriminant Validity: HAS Scores at Discharge by Discharge Placement

	Total Acuity		Medical Acuity		Behavioral Acuity	
	Test Statistic	Sig*	Test Statistic	Sig*	Test Statistic	Sig*
Independent Living, Living w/Family (Supervision)	16.48	.042	5.22	1.00	20.53	.006
Independent Living, AFC	41.85	.000	33.54	.000	34.71	.000
Living w/Family (Supervision), AFC	25.37	.001	28.32	.000	14.18	.110

*Bonferonni corrected

Changes in Acuity Admission to Discharge by Clinical Pathway



**Note: Change computed as (Discharge – Intake) so that a negative score is a reduction in symptoms (i.e. a good thing!).*

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What Happens to Acuity in Post-Acute Residential Placement?

- 4% Acuity Increased (got worse)
- 12% Acuity remained or increased by 1
- 84% Acuity Decreased by >1 (got better)

Why does acuity increase?

- Some people get worse.
- Some people become more active as they get better and emerge into agitation or impulsivity risks.
- New interventions and medications may reflect progress, but increase care complexity. (e.g. Serial Casting)
- It is more complex and time consuming to assist some alert, complex patients than provide efficient total care.

Why Do Some Patients INCREASE Acuity?

- Waking into greater activity levels
- Function of arousal and requirements for intervention
- Creating inadvertent dependence through caregiving vigilance