NRI
Outcome Validation Study Highlights for 2017

Demographics and Characteristics

The NRI Outcome Study for the period ending December 31, 2017, addressed the discharges of 27 individuals. There were 19 males and 8 female with ages at admission ranging from 29-59 years. The average length of stay (LOS) on the NRI program was 67 weeks with a range of 2-169 weeks. The average LOS in 2016 (30 weeks) was significantly shorter than 2017. This is partly due to having two patient with exceedingly long LOS near or beyond 2.5 years. When these two outliers are removed, the adjusted LOS for NRI in 2017 is 53 weeks.

Mechanism of Injury

The etiology of the brain injuries for the discharge population in this study includes motor vehicle crashes, anoxia, cerebrovascular accidents, and physical assault. Patients sustained moderate to severe injuries resulting in significant physical, medical, cognitive, and behavioral deficits. Many showed post-injury history of aggressive behavior including aggression toward self and others, elopement issues, non-compliance issues, and impaired impulse control. Patients had a range of cognitive problems involving attention, planning, organization, problem solving, and auditory, verbal and visual memory.

Program Overview

During 2017, the NRI program maintained a high census with the average of 35 patients. In January of 2017, Dr. Coby Nirider, PT, DPT took over direction of the program and of the physical therapy services. Currently, NRI has three full-time clinical therapists, a speech and language pathologist, an occupational therapist, an occupational therapy assistant. Additional staff include a recreational therapist and job coach and several student interns.

NRI patients are exposed to individual and group therapy across a variety of modalities. Individual sessions tend to focus on restoration or compensation for those deficits that pose the greatest barrier to independence and community reintegration. Group sessions serve to bolster the gains made in individual sessions by addressing similar deficits but in a group-training context. Recreational therapy, both on and off campus, is also frequently offered. For those interested in culinary activities, a cooking class meets weekly for NRI patients.

Our Transitional Living Center (TLC) continues to offer a less-restrictive environment for our patients that have had successful progress within the inpatient program. Here, patients are exposed to an appropriate level of structure with greater independence and the opportunity to initiate and complete tasks with minimal assistance such as cooking, domestic chores and budget shopping in the

community. In addition, new developments are being made in offering volunteer activities for TLC patients to include volunteering at various organizations in the community.

The Community Living Center (CLC) offers an even more flexible support model where patients can be provided support from zero to 24 hours per day. We had two patients participate in the CLC program in 2017.

We expanded our continuum of neurorehabilitation services in 2017 to include a community-based supported living, apartment program. We enrolled our first patient into this program in June. Initially we provided four hours of care per day, individual counseling and case management, as well as medical services. This plan has been slowly reduced to five hours per week of transportation support in addition to two telephonic check-ins per week. This has been a very successful first case for this program demonstrating not only our capacity to expand our services further into the community but also our ability to make significant clinical improvements in patients at this level of care.

Outcome Measures

The NRI outcome study continues to include objective outcome measures including the Brief Neuropsychological Cognitive Examination (Tonkonogy, 1997) and the Mayo-Portland Adaptability Inventory (MPAI-4) developed by Malec and Lezak (2003). To expand the utility of the MPAI-4 data we also analyze the tool's subscales. The objective measures above are combined with the subjective categorical measures that have historically been collected at NRI including the areas of Return to Independence, Social Role Return, Vocational Re-entry and Self Management. The categorical measure underwent some modifications in late 2017 to improve its specificity and ease of scoring. These changes can be seen in the tables below. Following is the NRI Outcome Validation Study for 2017.

Categorical Data Outcomes 2006-2017

TABLE 1. Return to Independence

The table below indicates that the discharge destination of clients who completed the NRI program primarily returned home or congregate living with minimal to moderate supports for 2017.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Return to independence with minimal to moderate support <6 hrs/day	45%	14%	14%	0%	13%	6%	24%	35%	17%	26%	17%	19%
Return to congregate living or extended supports in the home >6hrs/day	0%	14%	29%	50%	17%	65%	38%	19%	29%	16%	58%	37%
Return to group home with 24 hr/day support	33%	57%	14%	11%	37%	29%	19%	19%	27%	32%	0%	26%
Return to nursing home or hospital setting 24 hr/day care	22%	15%	43%	39%	33%	0%	19%	27%	27%	26%	25%	19%

TABLE 3. Social Role Return

The return to pre-injury social role is an important outcome measure for neurorehabilitation programs. We modified the rating scale for this domain in 2017. This makes comparison with prior years difficult. Despite this, however, we see that the percentage of persons returning home with minimal modifications to their social role (15%) is in line with the historical average of 14%.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Return home with independence and minimal modifications to social role	12%	0%	14%	28%	4%	11%	14%	35%	10%	16%	8%	15%
Return home or congregate living with moderate modifications to social role												33%
Significant modifications required preventing return to social role												52%
Return home to dependent care status	33%	33%	14%	11%	21%	17%	19%	10%	13%	11%	8%	
Return home with <2 hrs/day paid behavioral support	0%	33%	10%	0%	0%	0%	0%	6%	3%	5%	0%	
Return home with >2 hrs/day paid behavioral support	0%	0%	24%	11%	4%	17%	24%	6%	4%	5%	8%	
Attend day program providing structured care 3-5 days/week	33%	71%	14%	11%	8%	0%	10%	19%	13%	16%	0%	
24 hr/day Supervision	22%	0%	24%	39%	63%	55%	33%	24%	57%	47%	75%	

TABLE 2. Vocational Re-Entry

The return to meaningful life activities such as work, school, and volunteering is an important outcome measure for neurobehavioral rehabilitation programs. We saw a significant increase in patients returning to competitive employment, school, or training program in 2017. Removing the lowest functioning category from this domain resulted in a skewing of the data toward the "unable to work" category. This appears to give a more accurate depiction of the NRI population as it relates to the vocational re-entry domain.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Return to competitive employment, school or vocational training program	11%	0%	14%	0%	0%	6%	19%	11%	10%	5%	0%	11%
Supported employment or volunteer work	11%	17%	14%	0%	13%	22%	9%	0%	17%	26%	25%	15%
Sheltered workshop or day activity program	11%	33%	29%	11%	29%	17%	19%	0%	23%	21%	0%	4%
Unable to work	45%	33%	0%	50%	42%	44%	29%	79%	23%	16%	17%	70%
Requires 24 hr/day supervision	22%	17%	43%	39%	16%	11%	24%	10%	27%	32%	58%	

TABLE 4. Self-Management of Behavior

The self-management of one's behavior is a key factor in long-term success. The bottom two categories for this domain were removed in 2017 to improve specificity relative to this construct. Seventy percent of persons discharged in 2017 required no behavioral support at the time of discharge. The historical average for this category is 25%. The large shift in data might suggest that the prior categories contained more than one construct and we feel that this new categorization of the domain will result in a clearer depiction of our success in treating behavioral dysregulation.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
No behavioral support services required	45%	66%	28%	See MPAI results	0%	11%	23%	4%	23%	0%	0%	70%
Weekly contact with therapist, 0-5 outbursts per week	0%	17%	28%	See MPAI results	33%	44%	57%	24%	43%	47%	33%	30%
2 or more contacts per week with therapist, 6+ outbursts per week	0%	0%	0%	See MPAI results	16%	6%	10%	24%	10%	0%	0%	0%
Requires daily structured behavioral program	33%	0%	0%	See MPAI results	13%	6%	0%	24%	11%	32%	0%	
24 hour placement	22%	17%	44%	See MPAI results	38%	33%	10%	24%	13%	21%	67%	

Objective Measures Outcomes 2017

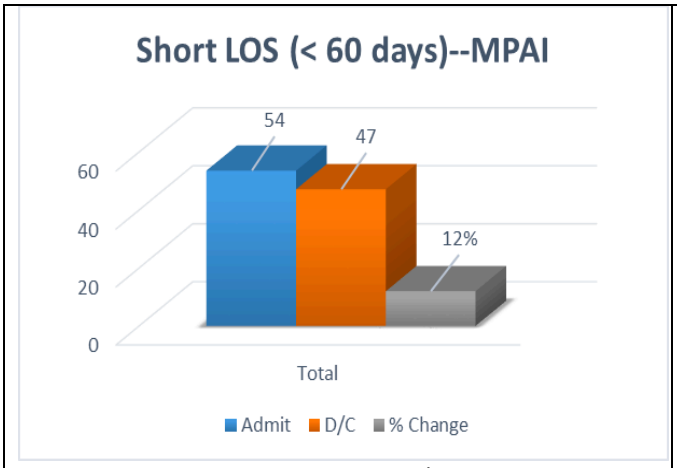
TABLE 5. MPAI-4 Scores

	Mayo-Portland Adaptability Inventory - 4				
	Ability	**Adjustment**	**Participation**	**Total**	**(N =)**
Admission	56	61	57	59	**25**
Discharge	48	48	49	49	**25**
Change	8	13	8	10	
% Chance	**15%**	**21%**	**15%**	**18%**	

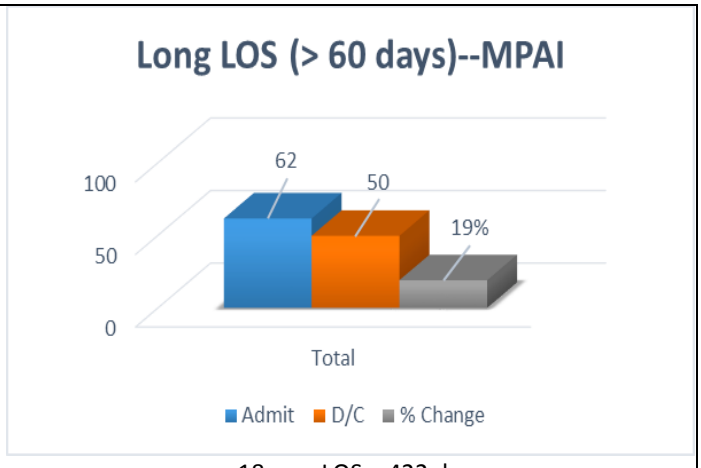
Table Notes

- MPAI-4: Scores reported as t-scores (Mean=50; Standard Deviation=10). Lower scores indicate a better level of functioning.
- MPAI-4: the following score cut-offs are relative to other persons with acquired brain injury:
  - 60 suggests severe limitations
  - 50-60 suggests moderate to severe limitations
  - 40-50 suggests mild to moderate limitations
  - 30-40 suggests mild limitations
  - < 30 suggests relatively good outcome

FIGURES 1 & 2: MPAI and Length of Stay (LOS)



n = 7; avg LOS = 20 days



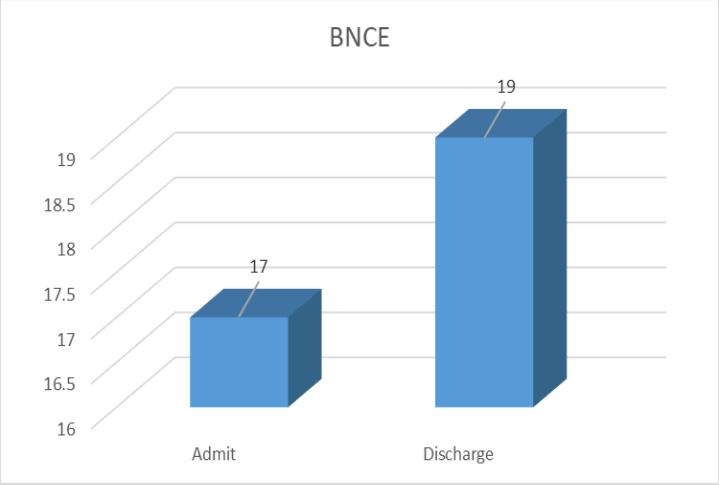
n =18; avg LOS = 422 days

Interpretation

The Mayo-Portland Adaptability Inventory (MPAI-4) average scores indicate significant overall improvement of our patients. Recall that lower scores are reflective of a higher level of functioning on the MPAI-4. Upon admission in 2017, patient's average score was 59 reflecting that our patients had severe injuries with significant deficits in body structure/function, activity limitations and participation restrictions. The average NRI discharge score was 49. The overall scores reflected an average improvement of 10 points (18%) demonstrating advanced recovery to the mild to moderate category. These outcomes are slightly lower than in 2016. This may be due to several factors including greater injury severity in 2016 and a much larger (>3 fold) sample size in 2017. One commonality of interested between 2016-7 is the large improvements seen in the Adjustment domain. This highlights our program's strength in managing the neuropsychiatric and neurobehavioral sequelae of acquired brain injuries.

We had 7 patients discharge in 2017 that had very short lengths (LOS) of stay (< 60 days). This is more than twice the number of short LOS cases in 2016. When we compare this sub-population's outcomes with those having a longer LOS, we note that the longer LOS group had more severe injuries upon admission and also had larger change scores on the MPAI (i.e., greater recovery) than the shorter LOS group.

TABLE 6. BNCE Scores



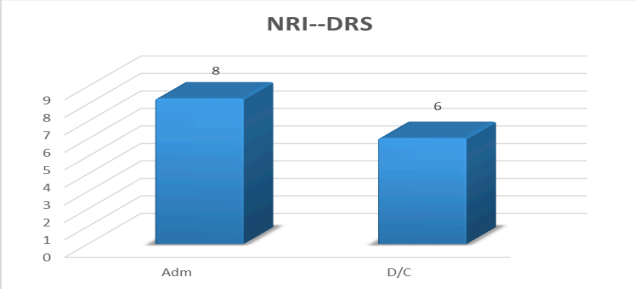
	BNCE	
	Total	**(N =)**
Admit	17	**9**
D/C	19	**9**
Change	2.0	

Table Notes
- BNCE: in general, a total score <22 indicates the individual may need significant support systems.
- BNCE: higher scores indicate a better level of functioning.

Interpretation

As seen in Table 6, the BNCE data and cut-off scores reflect that the NRI patients at admission had deficits related to their injury that ranged from Moderate to Severe. The average admission score of 17 denotes a moderate severity of impairment and suggests that these individuals will struggle to live without significant support systems. The average discharge score of 19, while still in the moderate severity range, approached the cut-off for mild severity (22 pts).

TABLE 7. DRS Scores



Interpretation

We began collecting Disability Rating Scale (DRS) scores in 2017 and Table 7 shows the change in DRS scores for a sample of 19 patients. For comparison, patients with TBI will, on average admit to acute rehabilitation with a DRS of 12 and discharge with a score of 6. At one and two-years post TBI, scores will average 2.9 and 2.6 respectively. Our patients improved an average of 2 points suggesting continued recovery in this phase of rehabilitation.

Conclusion

The NRI program has used categorical and objective measures for program evaluation for the more than ten years. Taken collectively, 2017 data suggest that NRI continues to admit patients with very severe deficits affecting all domains of function. Despite this fact, NRI programming continues to have a positive impact on its patients.

Respectfully submitted,

Coby D. Nirider, PT, DPT, CBIS
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