Early vs. Late Treatment of Traumatic Brain Injury

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The Board of Directors of the Brain Injury Association of America adopted this position paper at its meeting on August 28, 2009, in Chicago, IL. The Association will continue to review the topic of early versus late treatment as medical and public policy progress dictate.

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Anecdotal case reports regarding the dramatic effectiveness of rehabilitation following brain injury have largely centered on those few individuals where financial constraints were not an issue. The phenomenal return to broadcast journalism by Bob Woodruff of ABC News following a severe brain injury reflects the medical rehabilitation outcomes possible in the 21st century when seamless and timely acute neurotrauma care and medical rehabilitation is provided to the individual. For the vast majority of U.S. citizens, this opportunity does not exist. Financial and access to treatment constraints imposed by third party payers preclude best outcomes from being realized. The existence of "Bob Woodruffs" in the world represents the recovery of outcome attainable in today's system of brain injury treatment as a result of decades of neuroscientific research.

In a healthcare environment focused on cost containment, treatment following brain injury face time and intensity constraints imposed by third party payers. A clear trend toward earlier discharge from any phase of rehabilitation intervention currently exists, whether hospital or non-hospital based. Existing outcome literature reflects these disturbing trends. Re-hospitalization rates increased from 14.8% in 1994 to 18% in 1998 for people with disabilities most likely reflecting such treatment constraints.[1] More significantly, mortality rates at 80 to 180 day follow-up increased more than fivefold in the seven year period from 1994 (0.9%) to 2001 (4.7%).[1]

Significant financial investment beginning in the late 1970s by the Federal government and private foundations improved mortality rates from severe brain injuries through aggressive acute neurotrauma management and physiologic stabilization. With that increase in survivability came the need for a more comprehensive approach to neurorehabilitation. The field of postacute rehabilitation for brain injury had its origins during that period of time when the length of stay in acute rehabilitation settings for patients with brain injury lasted months. While clinical wisdom at the time was that recovery was complete at 6 months post injury, data mined from the Traumatic Coma Bank in the 1980s defined a window of opportunity for recovery that was far longer.

Despite advances in the acute salvaging of lives and neuroscientific understanding of the potential for neurogenesis and repair following brain injury, trends to reduce lengths of stay for acute hospitalization and rehabilitation continued. Early data from the TBI Model Systems project placed acute hospital LOS in 1990 at 29 days and rehabilitation hospitalization LOS at 48 days.[2] By 1995, acute LOS was reduced to 20 days and one year later reduced again to an average of 16 days while the average LOS for rehabilitation hospitalization decreased to 29.49 days.[2] Over that time period, brain injury severity and incidence remained constant.

Commercial and government sponsored health insurance coverage provide inadequate and restrictive access to treatment following brain injury. The projected financial risk of an insurer for the lifetime care of a person disabled by brain injury impacts treatment benefits provided for the insured. If no long-term responsibility for care exists, acute care and rehabilitation benefits are more limited. For example, a full continuum of rehabilitation exists across the country to provide the workers' compensation insurance sector a mechanism to maximally reduce long-

term financial risk arising from the fact that due to disability these carriers have a contractual liability for lifetime care costs. Conversely, the absence of similar long-term contractual liability in the health insurance sector incentivizes this sector to prohibit access to treatment.

Approximately, two-thirds of all individuals who are hospitalized for their brain injury, are discharged home with no further medical rehabilitative treatment.[3] As patients are discharged from hospital care to home settings, most policies prohibit admission to intensive residential rehabilitation once the patient is discharged to home. Thus, the intensity and less specialization of expertise is not made available to these patients, leaving them with much less intense and specialized outpatient services or no treatment at all, resulting in greater long-term disability and less functional independence. In some instances, policies further restrict access to rehabilitation by arbitrary limits averaging LOS of 30 or 60 days, and/or disallow payment to non-hospital based facilities. As a consequence, patients are denied treatment, do not recover as completely or as rapidly resulting in a lower likelihood of achieving their maximum potential for independence and vocational or academic return. The long-term financial liability of this needlessly heightened disability is transferred to the public sector in the form of medical, housing, income or other assistance.[4]

The vast majority of individuals discharged from the hospital following brain injury are discharged home with no further rehabilitative treatment. [3] Unfortunately, these individuals are at a greater risk for re-injury and re-hospitalization due to unresolved physical and cognitive deficits. Additionally, caregivers may not be educated or equipped enough to provide the level of supervision and care that is necessary following brain injury.

Outcome studies have measured the impact of comprehensive rehabilitation by comparing patient independence as a function of early versus later access to medical treatment and postacute residential rehabilitation for brain injury. In one study, Ashley and Persel [5] longitudinally followed 511 patients with closed (89%) or open (11%) head injuries, ranging in age from 6 to 77 years. The sample was comprised of 83% males and 17% females with time from injury to admission to postacute residential rehabilitation (chronicity) ranging from 5 days to 24.4 years. Mechanism of injury was as follows: MVA: 51%; falls: 40.1%; gunshot wounds: 3.8%; and other: 4.4%. Treatment consisted of physical, occupational, speech, counseling and educational therapies up to 6 hours per day, 5 days per week on a one-to-one therapist to patient basis. Additional inpatient structured therapy was conducted in the residential setting during the mornings, evenings, and weekends with therapy initially conducted on a one-to-one basis until sufficient self care skills developed to enable a lesser level of intervention.

Retrospective analyses of differences in cost, length of stay (LOS) and Disability Rating Scale (DRS) score changes from admission to discharge were calculated for patients grouped by chronicity: less than 6 months, 6-18 months and greater than 18 months. While no statistically significant differences existed across groups for age, the early group (less than 6 months) had statistically significant lower LOS and program costs than the other two groups. The later two groups were not significantly different from each other for age, LOS or program cost. All groups showed statistically significant improvement in the DRS, level of supervision required and occupational status from admission to discharge. Between group differences were not found on admission DRS or occupational status. However, there were differences between the three

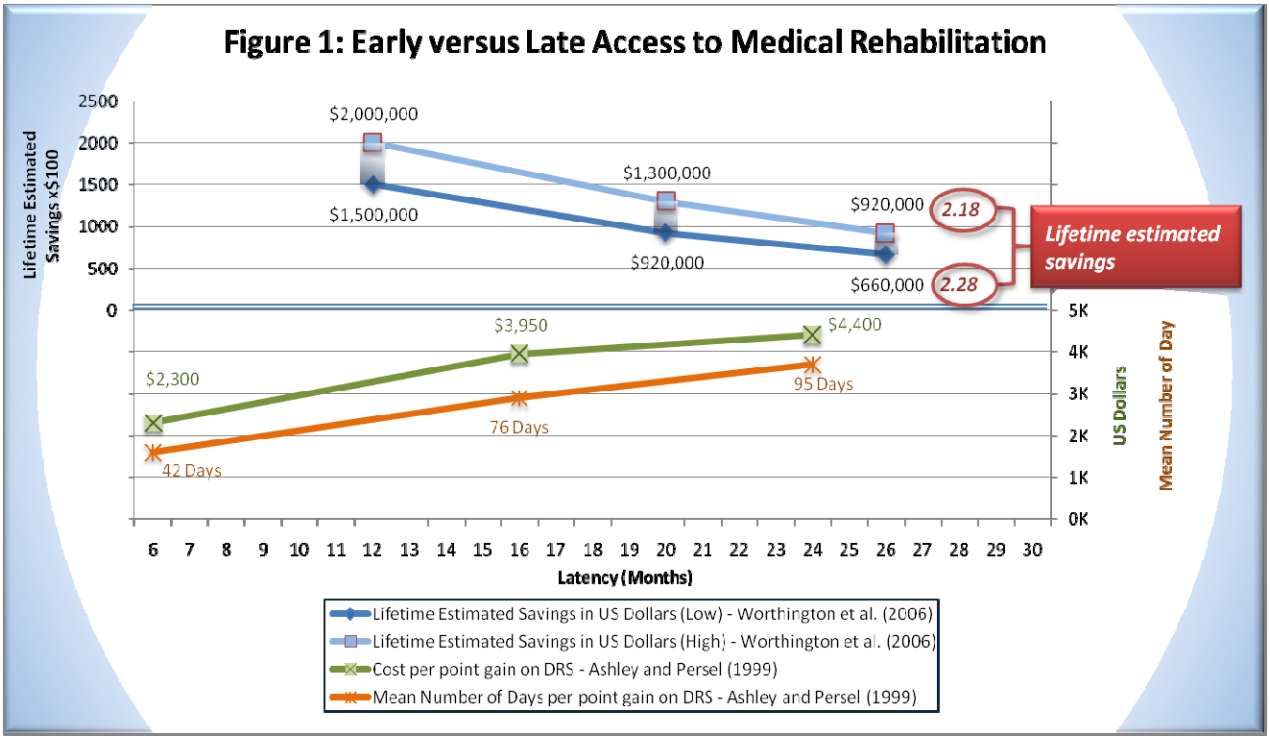
groups for admission level of supervision. Supervision decreased with chronicity. Discharge differences between the groups were found for DRS, level of supervision and occupational status between the shortest chronicity group and the later two groups only.

The authors reported the actual cost of increasing level of independence at discharge as reflected by number points of improvement on the DRS. The mean number of days per point improvement on the DRS was 41.87 days (<6 months), 76.32 days (6-18 months) and 95.30 days (18 months). Our analysis of this data showed that the later treatment group required 2.28 times more time per point improvement on the DRS than the less than 6 months group. The cost per point improvement on the DRS was $23, 283.78 for the less than 6 months group, $34,499.14 for the 6-18 months group and $44,175.00 for the greater than 18 months group. Our analysis of the data showed that delaying treatment for more than 18 months resulted in a 1.89 fold greater expense when compared to those receiving rehabilitation less than 6 months post-injury. Ashley and Persel [5] further provided data showing change in ranked level of required supervision from admission to discharge for the three groups: less than 6 months experienced as change of 4.53; 6-18 month had a change of 2.6 and the greater than 18 months group had a change of 1.67. Our analysis of this data showed the early group achieved 2.7 times greater reduction in ranked levels of required supervision than the latest group.

Wood et al [6] reviewed the clinical and cost effectiveness of postacute neurobehavioral rehabilitation for 76 patients with brain injury who had spent at least 6 months in rehabilitation prior to the study. The average age of the group was 27 years, 57 were male and 19 were female. Causes of brain injury included motor vehicle accident (N=48); fall (N=7); assault (N=3); intracranial haemorrhage (N=12); hypoxia (N=1); encephalitis (N=1) and other (N=4). Time since injury averaged 72.83 months and length of rehabilitation delivered after the initial 6 months of rehabilitation was 14.32 months. Patients were grouped by time since injury into three groups: 0 to 2 years; 2 to 5 years; and more than 5 years. Retrospective analysis compared mean hours of care required per day pre-admission versus that needed at follow-up post discharge. A reduction in mean pre-admission to follow-up care requirements was noted across all groups: 22.8 versus 10.39 hours (0-2 years group); 19.88 versus 13.25 hours (2-5 years group); and 21.25 versus. 16.67 hours (over 5 years group). When determining if a proportion exists between the hours of care per day and the time from injury to admission into rehabilitation, it was discovered that when the early group (0-2 years) is compared to the average of the other groups (2-5 years and over 5 years), 1.88 times more hours of care per day were required in these groups than in the early group (0-2 years). Comparison of the latest group (over 5 years post injury) to the earliest group (0-2 years post-injury) demonstrated that the latest group required 2.71 times more hours of care than the early group.

Worthington et al [7] reviewed cost-benefits associated with neurobehavioral rehabilitation following brain injury for 133 patients of whom 101 were male. Etiology of injury was comprised of 33.8% MVA, 9% falls, 8.3% assault, 18% intracranial hemorrhage/CVA, 16.6% hypoxia/hypoglycemia, 8.3% encephalitis, 3% neoplasm and 3% other. Average age was 26.4 years, coma duration averaged 14 days, time since injury averaged 96 weeks, and rehabilitation length of stay averaged 20 weeks. The patients were grouped according to time since injury at the time of admission to rehabilitation into three groups: less than 1 year, less than 2 years, and greater than 3 years. When the influence of early versus later access to rehabilitation was

compared to the estimated lifetime care cost savings following rehabilitation, our analysis showed that while all groups realized substantial lifetime cost savings, the earlier groups (less than one year and less than 2 years) saved more than the latest group (greater than 3 years). Lifetime savings costs were 2.2 times greater for the less than one year group than the greater than three years group.



Discussion

Indisputable evidence exists as outlined above that early rehabilitation interventions following brain injury are less expensive and more time efficient when compared to rehabilitation that is delayed. Measurement improvement is obtained regardless of how long after the injury the rehabilitation is received, but earlier intervention is less expensive, of higher value and more rapid. A remarkable proportionality emerges upon comparison of the findings of the three primary studies reviewed: Ashley and Persel [5] provide insight into cost per unit of recovery and rate of recovery in the mean cost per point improvement on the DRS and days to achieve one point improvement on the DRS, respectively. Early to late treatment ratios of 1.88 are seen for cost per unit of recovery and 2.28 for rate of recovery, where early treatment is 1.88 to 2.28 times more efficient than late treatment. Further analysis of the Ashley and Persel [5] data revealed an early to late treatment ratio of 2.7 in ranked level of supervision.

The data from Wood et al [6] demonstrate similar proportionality in mean hours of care per day requirements with early treatment being 1.88 times more efficient than late treatment when comparing less than and greater than 2 years time since injury groups. When comparing less than 2 years to greater than 5 years, the efficiency soared to 2.71 times. This ratio compares favorably with that found in the Ashley and Persel [5] data of ranked level of required supervision at 2.7.

Further analysis of the Worthington et al [7] study found remarkably consistent proportionality of efficiency comparing the lifetime cost savings between early and late treatment groups where the early treatment group realized 2.2 times more lifetime cost savings than the late treatment group. Remarkably, three independent studies of different patient groups by unrelated authors show a proportionality in strikingly different outcome measures of cost per unit of recovery, rate of recovery, level of required supervision, required hours of care per day and lifetime cost savings. These data taken together strongly suggest that early rehabilitation can be conducted for essentially two times (1.88) less cost, can achieve roughly twice the rate of recovery (2.28), can reduce level of required supervision and hours of care per day by half or more (1.88 to 2.71), and can produce approximately two times (2.2) more lifetime cost savings than late rehabilitation.

The implications for these findings are striking. First, these studies provide objective evidence that rehabilitation provided more than 2 years post injury is effective in reducing disability, reducing care and supervision needs and achieving substantial lifetime cost savings. Turner-Stokes et al [8] reviewed this specific issue and demonstrated that rehabilitation with patients longer than 2 years post injury could not only achieve these improvements but that the cost of rehabilitation could be reliably recouped in annual cost of care savings within the first two years post treatment.

Second, the current practice of severely truncated lengths of stay at hospital and non-hospital based rehabilitation venues has no scientific basis and represents misguided clinical and cost containment practice. It is clear that early intervention of sufficient duration provides significant benefits in rate of recovery, cost per unit of recovery, care requirements and reduction of lifetime costs. To that end, payer practices that truncate lengths of stay are ill informed and detrimental to the public welfare as, financial liability is transferred to the public sector, unnecessarily burdening that system with substantially higher long-term costs. Turner-Stokes et al [8] conclude that policies that arbitrarily restrict treatment to specific time periods likely increase the overall cost of care rather than contain costs.

These findings provide convincing support for policy change relative to the manner by which rehabilitation treatment following brain injury is approached, authorized, and delivered. True cost efficiency has been and remains founded in early, intensive and effective rehabilitation following brain injury.

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