SABBATICAL REPORT

By

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Traumatic Head Injuries and Neuropsychological Assessment; A Causal Relationship: The Educational Implication for Community College Students

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Chapter I

Epidemiology of Head Injury

Head injury is a major public health problem, both in terms of mortality and morbidity. Many severely head-injured patients die before reaching the hospital. Survivors often have serious long-term after-effects (including post-traumatic epilepsy and neuropsychological deficits).

Trauma is the leading cause of death in youth and early middle age and is the third most common cause of death in the United States; it is exceeded only by vascular disease and cancer. When death is caused by trauma, head injury is a significant contributing factors in more than half of the cases. In patients who have multiple injuries, the head is the part of the body most commonly injured and in fatal accidents injury to the brain occurs in nearly 75% of the cases (Lynen, 1963:847). Although the incidence of head injury is highest among persons aged 15 to 25 years, it still exceeds stroke as a cause of death in males aged 45 to 64 years. Obviously, many of the victims of head injury would have had many years of life remaining; instead their lives were cut short or they live with significant neurological and neuropsychological deficits.

The incidence of head injuries has had variable estimates. Some investigators reported about 200 persons

with head injury per 100,000 population (Kalsbeek, McLaurin, Harris, & Miller, 1980) and others have estimated as many as 600 head-injured persons per 100,000 population (Kalsbeek, McLaurin, Harris, & Miller, 1980) and others have estimated as many as 600 head-injured persons per 100,000 population (Caveness, 1977).

These differences are probably due to the researcher's definition of "head injury"; using a criterion such as "a head blow that leads to restricted activity for at least one day" will naturally produce higher figures than a criterion such as "loss of consciousness of presence of post-traumatic amnesia." When the injury is sufficiently severe to require hospitalization, estimates have been in the vicinity of 300-350 cases of head injury per 100,000 members of the population, although approximately half of these patients were discharged within 24 hours of admission (Hall, 1985). The National Head and Spinal Cord Injury Survey of head injuries in the United States in 1974 estimated about 404 head injuries per 100,000 members of the population, with a distribution of 272 males and 132 females (Anderson, Kalsbeek & Hartwell, 1980).

Similar figures were reported by other investigators (Gerber, 1979), who estimated 274 cases per 100,000 among males and 116 cases per 100,000 among females. Craine (1981) estimated that in 1974 approximately 8.1 million Americans

had head injuries and of this number about 1.9 million persons had injuries sufficiently severe to suggest the possibility of brain damage. Although these figures vary rather widely, it is apparent that injury to the head constitutes a major public health problem.

There have been some studies of the conditions under which head injuries occur, although there are also difficulties in obtaining accurate data in this area. Road and traffic accidents almost certainly represent the major cause of head injuries in the civilian population and probably account for nearly 50%. Among persons injured in traffic accidents, approximately 70% have been estimated to have sustained a head injury. Domestic accidents or falls account for about 20%; about 10% result from industrial injuries; 10% represent cases of assault; and sport injuries represent approximately 5% of the cases. The remaining 5%-10% are caused by other factors. These findings coincide with the writer's observations of students with head injuries at Mt. SAC. Of the students applying for services with head injuries, 60% occur by motorcycle accidents.

In terms of the age distribution, head injuries are known to occur more frequently among younger persons, particularly males. In the 15 to 25 year age range there appears to be a peak incidence among males that far exceeds the female distribution. Caveness (1976) found that head

injury was the leading cause of death in males under the age of 35 and the leading cause of death among females under the age of 25. Goldstein (1983) reported that hospital admissions for head injury were about four times as frequent among males as females.

Additional reports have indicated that head injuries are more common among persons in lower socioeconomic levels and alcohol abuse has been noted as an especially significant factor. Bracy (1983) report that about 20% of their head injury hospital admissions have significant problems with alcohol or drug abuse, psychiatric disorders, or intellectual retardation. While these figures suggest that victims of head injury have many pre-existing problems and do not appear to represent a cross-section of the population, a large number of otherwise healthy persons, particularly in the younger parts of the age distribution, suffer significant and permanent cognitive losses due to head trauma. When the number of years of potential productive living are considered, head injury takes a very high toll. While various estimates have been made regarding the economic costs of head injuries (in terms of days lost from work, hospitalization expenses, etc.), the principal loss to society is probably represented by the long-term neuropsychological deficits among survivors.

Chapter II

What is ABI?

Definition of Acquired Brain Injury (ABI)

Acquired brain injury is an acquired impairment of medically verifiable brain functioning resulting in a loss of partial loss of one or more of the following syndromes of cognitive, communication, psychomotor, psychosocial, and sensory/perceptual abilities. The preceding deficiencies are defined as follows:

a. Cognitive - loss or partial loss of memory function, attention, concentration, judgment and problem solving, mental flexibility, organizational thinking skills, spatial orientation and information;

b. Communication - impairment of speech, language and pragmatics (pragmatics is defined as the appropriate use of semantic and non-semantic rules governing communication);

c. Psychosocial - Untoward social behavior or impaired psycho-dynamics that limit or impede interpersonal relationships, coping strategies and goal-directed behavior;

d. Sensory/perceptual - Deficiencies in primary perceptual systems such as visual, auditory and tactile;

e. Psychomotor - Limitation in locomotion or motor

functions and/or physiological dysfunction of a body part or system.

Chapter III

Incidental Statistics of Acquired Brain Injury

The statistics are staggering. Estimates suggest that in the United States each year there are upwards of 1 million cases of head injury requiring hospitalization (Berrol & Rosenthal, 1986; Kurtzke, 1982). In terms of all head injury, regardless of hospitalization or severity of injury, the number may be as high as 3 million per year (Cartlidge & Shaw, 1981; Dikman & Reitan, 1977; Jennett, 1983a). At least 10% of the individuals who survive a significant head injury are likely to have residual deficits that result in total and permanent incapacity (Kingston, 1985). The majority of the remaining head injury victims are likely to suffer at least some transient cognitive, motor, or sensory aberration, and somewhere between 40% to 80% of these patients will have residual physical, intellectual, or behavioral deficits (Fisher, 1985; Levin, Benton, & Grossman, 1982; National Head Injury Foundation, 1982). The most frequently injured group of individuals is males between the age of 15 and 24. Such individuals constitute 50% of all head injury cases. Furthermore, for this group the incidence rate of head injury is 600 per 100,000 population as compared to an overall general population incidence rate of 200 per 100,000 population (Fisher, 1985; Jennett, 1983a; Levin, et al.,

1982; Rivara & Mueller, 1986). In terms of the economic burden, the cost involved in rehabilitating head injured patients has been estimated to be between $5 and $10 billion annually (Anderson & McLaurin, 1980), and the economic loss may reach upwards of $25 to $30 billion (Johnston, 1987). Because new patients are added to the head injured ranks each day, this is a problem that continues to expand.

The tragedy of these statistics is that the injury occurs at a time in most individuals' lives when the demands to be productive (e.g., school, work, establishing a career) and independent (e.g., emerging adolescence or adulthood, establishing a family, etc.) are the most pervasive. The resultant physical, cognitive, and/or behavioral deficits may be permanent (Klonoff, Costa, & Snow, 1986; Rimel & Jane, 1983), and patients may never return to their previous level of independence and productivity. Over the past two decades the initial medical and physical treatment of head injury has become fairly well understood and regimented (Jennett, 1986; Miller, 1985). However, it is the long-term effects of brain injury, and particularly the cognitive and behavioral deficits (i.e., the learning disabilities), that constitute the current challenge of treatment, rehabilitation, and research. Since "The brain is the sum total of all we are," (Eccles, 1983) states, injury to this structure, which constitutes our very being, is inherently going to have a

multifaceted impact upon all aspects of behavior. Accordingly, it is necessary to have an understanding at many levels of the mechanisms of brain injury and its effects upon behavior.

It is only recently that patients with head injury have received comprehensive treatment programs that have dealt with the various cognitive and behavioral outcome deficits that accompany brain injury. Thus, for the brain injured patient, the clinical acumen available for long-term treatment is limited but improving.

Jennett (1983b) states that,

> Although head injury is 10 times more frequent than spinal injuries, there is much less chance that the victim of a head injury will be fortunate enough to find a coherent and expertly conceived rehabilitation program. The problems of paraplegia are fairly stereotyped and well understood, with solutions available for most of them. By comparison, the disabilities after head injury are complex and varied, and are seldom fully recognized; even when they are, their management is often difficult. The main reason for this is that the mental deficits dominate--and these interfere both with the patient's ability to cope and with the capacity for cooperation with those trying to help the patient.

Recently there has been an influx of colleges creating programs for ABI students. However, these programs are in the infancy stage. It does appear that an established program at the college level is an excellent vehicle to teach brain-injured students towards rehabilitation. Moreover, since the incidental rate of brain injured is between ages 15 and 24, the college program seems to be an excellent idea for this population.

Chapter IV

Neurological Models for Diagnosing Brain Injury

Prior to the recent advances in emergency medicine, many patients were cerebral injury died (Lillehei & Hoff, 1985). However, since the 1960s and the advent of fully staffed emergency programs, the development of regional trauma centers, and availability of neurosurgeons, along with the development of critical and acute care management of the brain injured patient, the individual with a brain injury now stands a better chance of survival (Miller & Jones, 1985). Survival, though, has required the development of programs to meet the long-term needs of these individuals.

For the longest time clinicians dealing with the brain injured patient have been under the assumption that once a brain injury victim passes through the spontaneous recovery phase, there is little that can be done to assist the patient with recovery, because brain damage is "permanent." We now realize that these brain injury victims can be helped beyond this spontaneous recovery phase, and that there is a considerable amount of treatment and rehabilitation programming that can be developed for the individual with residual physical, cognitive, and behavioral deficits as a consequence of brain injury. It is also evident that unique applications of the principles of learning theory to the

brain damaged individual (Gouvier, Webster, & Blanton, 1986; Horton & Sautter, 1986; Rosenthal & Geckler, 1986) may assist in the recovery process. Thus, in the 1980s we realize that the situation for brain injured individuals is far from hopeless, and that there are a variety of methodologies that can be applied in the evaluation and treatment of such individuals.

As previously discussed, the majority of individuals that sustain head injury are adolescents or young adults. As a result of this age range, many of these individuals are likely to be involved in the public education process. For the child or adolescent patient who has not completed high school and is under 21 years of age, there is a public responsibility for education under federal law P.L. 94-142, the Education for All Handicapped Children Act (1977). In point of fact, some estimates indicate that 20% of all children receiving special education for learning disabilities may have had a prior brain injury (Spivack, 1986). From this perspective, many of the deficit performance problems of the brain injured individual are similar to various learning disorders. In fact, many of the strategies in the treatment of learning disabilities have also proven to be useful in treating individuals with acquired brain injury (Cohen, 1986).

Neurological models of brain function long have served

as a basis for insight into learning disorders (Denckla, 1979). For example, the early theories of language and reading disorders that emerged in the first half of this century were based on neurologic models from patients with acquired brain injury (Hynd, Obrzut, Hayes, & Becker, 1986). Along these lines, Kolb and Whishaw (1985) provide an outline on the neurological basis of reading and spelling disabilities based upon the effects of various brain lesions in children and adults with acquired brain injury. Much of the theoretical progress in the neuropsychology of learning disorders is directly related to improved understanding of brain function gained by studying the effects of brain injury upon behavior and cognition (Rourke, Bakker, Fisk, & Strang, 1983). Because brain injury typically has such a significant impact upon an individual's learning ability, it is no wonder that residual learning problems attend the individual with acquired cerebral injury.

In the neurological model, there are several classification schemes using the EEG to define the degree of brain injury (Kiloh, McComas, & Osselton, 1979). The CT and MRI studies may demonstrate the presence of cerebral contusion, hemorrhage, edema, and other structural lesions that occur with brain injury (Raichle, 1986). Recently, the addition of computerized technology to EEG assessments has yielded even more diagnostically sensitive measures to the

detection of abnormal physiological functioning. To date, the best researched procedure is the brain electrical activity mapping (BEAM) technique, pioneered by Duffy (Duffy & McAnulty, 1985). The BEAM technique is particularly sensitive in detecting abnormal physiological patterns in "mild" head injury cases as well as secondary sites of dysfunction in cases of lateralized brain injury.

Thus, the third dimension that needs to be added to the definition of brain injury is whether the patient shows any physical evidence of neurological injury on direct examination using CT, MRI, or EEG in addition to the original change in level of consciousness and presence or absence of PTA. Likewise, direct physical examination of the patient may show clinical syndromes such as aphasia, paralysis, or sensory deficit.

In summary, a single definitional statement cannot be made that encompasses the complexity of brain injury. Thus, the sufficient and necessary factors that need to be present for the presence of significant brain injury should be in the context of one or any combination of the following: (a) alteration in the level of consciousness sufficient to produce a Glasgow Coma Scale rating of 14 or lower; (b) post-traumatic amnesia of 5 minutes or greater; (c) physiologic evidence (e.g., EEG), radiologic evidence (e.g., CT, MRI), or objective physical findings (e.g., paralysis, aphasia,

sensory deficit).

Causes of Head Injury

Head injury occurs in a diverse fashion. The majority of head injuries occur as a consequence of motor vehicle accidents, followed by motorcycle and bicycle accidents (Rivara & Mueller, 1986). Exact statistics are difficult to ascertain, but head injuries resulting from falls from heights, pedestrian injuries, and assaults also contribute a frequent source (Kaufman, Makela, Lee, Haid, & Gildenberg, 1986; Levin et al, 1982). It also should be noted that in pediatric head injury in child abuse (particularly that caused by violent shaking) is a significant source of cerebral injury (Alexander, Schor, & Smith, 1986; Cohen, Kaufman, Myers, & Towbin, 1986; Dykes, 1986).

The Psychoneurological Models of Brain Functioning

In order to understand acquired brain injuries, it is helpful to relate them to specific models of brain functioning. There are two major models of brain functioning; those described by Luria (1973), a permanent Russian neuropsychologist, and those described by Reitan (1986), a neuropsychologist at the University of Arizona. There are certainly more similarities between these models than differences, but some of the noted differences will be

highlighted in this review of literature.

Luria's model divides brain functioning into three major units. Those three major units are the arousal function, the receptive/integrative function, and the expressive/executive function. The first functioning unit involves the arousal mechanisms. It is primarily responsible for the quality and tone with which one engages in the thinking process. The lower brain structure (subcortical) are felt to be the responsible regions of the arousal management. Dysfunctions within the unit result in poor concentration, distractibility, and fluctuating responses, attentional impersistence, poor vigilance, and weakening mental stamina.

The second Luria functioning unit involved primarily the perceptual and receptive functioning of cognition. The abilities to analyze, to integrate, and to store information are included within the functioning unit. Posterior and lateral zones of the higher cortex are the structures associated with these functionings. These cortical regions include the occipital area (visual), the temporal area (auditory), and the post-central gyrus area (tactile and kinesthetic).

In addition, there is a large association region (parietal area) in which information is integrated into the organized unit. It is also postulated that within this unit there are three levels of projection zones.

1. The primary zone is responsible for simple sensory perception of information.
2. The secondary zones provides rudimentary meaning and association of perceptual data.
3. The tertiary zone provides integration and perception data into meaningful units of information.

The final functioning unit of the brain involves the expressive mode of one's thinking process and motor actions, including planning, programming, verifying, regulating, and modifying one's functionable output. Anterior cortical structures, specifically the frontal lobes, are responsible for the higher form of cognitive and behavioral actions. Extensive interconnections with other posterior and lower brain structures also exist to coordinate efforts for efficient thinking and behavioral actions. This functioning with this unit leads to perseveration, deficient errors recognition and corrections, impaired planning, sequencing, and prioritizing problems, poor regulation and imitation of behavior. This, in addition, to purporsefulness and lack of deterring skills as in problem solving.

In order to truly understand Luria's functioning dynamics of the brain, an outline of the nature of his three systems is presented in the following table.

Figure 1

Luria's Model

Unit 1 - Arousal Function

Purpose	Arousal of cortex
Location	Ascending reticular formation structures in brain stem Thalamohypothalamic region Parts of old limbic system
Operation	Ascending reticular formation maintains "tone" of the cortex and is controlled by descending cortical influences.
Dysfunction	Impaired vigilance; fluctuating responsiveness; fatigue and lack of mental stamina

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Unit 2 - Receptive.Integrative Function

Purpose	Reception, analysis, and storage of information
Location	Posterolateral zones of cerebral hemispheres; parts with high specificity include occipital (visual) area, temporal (auditory) area, post-central gyrus (tactile) area, and parietal (association) area
Operation	Primary projection zones ("raw" input comes here)

	Secondary projection zones (associations are made here which relate to the specific input)
	Tertiary zones (integration of the information across zones and modalities)
Dysfunction	Primary projection zones - absent sensory reception
	Secondary projection zones - deficient associations, e.g. letter agnosia
	Tertiary projection zone - deficient integration, e.g., unable to see a gestalt-like identifying a word

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Unit 3 - Expressive/Executive Function

Purpose	Programming, regulating, verifying complex forms of activity
Location	Anterior zones of cerebral hemispheres (frontal lobe)
Operation	Extensive interconnections with other units
Dysfunction	Perseveration, impersistence, deficient error correction, deficient error utilization, impaired sequencing, disinhibited behavior, indifferent behavior.

The Reitan Model is basically one of hemispheric specialization. Reitan views the brain as being organized structurally and functionably into two major globes of hemispheres. Each hemisphere has associated with it a unique cognitive style of information processing. The left hemisphere is considered to be predominant for language-related functioning, including phonemic, incoding, writing, reading, and verbalizing. In addition, sequential, analytic, and propositional thinking skills have been associated with the left hemisphere.

The right hemisphere is considered to be predominantly non-linguistic, although pragmatic language skills appear to be integrally involved in right hemisphere functioning. Spatial reasoning, form perception, synthetic and holistic thinking are also typically associated with right hemisphere processing. In order to understand Reitan's view of left-right hemisphere functioning, Figure No. 2 provides this analysis.

Figure No. 2

Reitan's Model

Left Hemisphere	Right Hemisphere
Speech	Spatial
Language	Orientation
Complex Motor	Picture/Pattern
Functions	Sense
Vigilance	Performance-like
Paired Associate	Functions
Learning	Spatial Integration
Verbal Abilities	Creative Associative
Linguistic	Thinking
Description	Calculation
Verbal Ideation	Simple Language
Conceptual	Comprehension
Similarities	Non-verbal Ideation
Time Analysis	Facial
Detail Analysis	Identification
Arithmetic	Recognition of
Writing	Environmental Sounds
Calculation	Non-verbal Paired
Finger Naming	Associate Learning
Right-Left	Tactile
Orientation	Perception

Although the differences between the two theories were presented, there are certainly more similarities than differences in Luria's and Reitan's models.

The dependent variables that both theories agree upon in analyzing ABI is the degree of the impairment, followed by a number of dependable factors, which may preclude one's recovery from a brain injury.

1. Age - The age of onset is perhaps the most importance criterion towards one recovering from a head injury.
2. The type of injury - The type of injury relates to whether it is an open or closed injury and the extent of the injury.
3. The area of damage - What area of the brain was damaged? Obviously, damage to the frontal lobe is going to cause a greater degree of difficulties than to the occipital lobe.
4. Pre-injury intellectual, physical, and mental status - What was the functioning status of the claimant prior to the onset of the head injury? If the client was of high intellect or in good physical health and had excellent mental capabilities, perhaps this person is more capable of surviving an ABI and functioning adequately.
5. Medical support and rehabilitation - How quickly is

the person able to receive medical support directly after the injury? Further, is the person placed into a rehabilitative program to work on the areas of deficit?

6. Post-injury support system - To what extent does the claimant have support from the family, medical, and psychological assistance while attempting to undergo rehabilitation?
7. Socio-economic status - Individuals of high SES, who were able to acquire a great deal of medical care evidenced a higher probability towards improvement than those who have low SES and are unable to get immediate medical attention.

Case Study With the Psychoneurological Model

During the course of this sabbatical, this writer had the opportunity of visiting several colleges and treatment programs that serviced ABI clients and students. Perhaps, the most exciting phase of this sabbatical was the opportunity to learn how to administer both the Luria Nebraska and Halstead Reitan Tests which assess neuropsychological functioning. This writer had the opportunity of developing case studies and presenting them to a number of medical teams at the Department of Rehabilitation in Inland Valley Neuropsychological Services. The following

is one of the most exciting case studies this writer had the opportunity of presenting to the medical team during this sabbatical. In this case study, the Halstead Reitan Assessment Battery was utilized on this claimant. It should be noted that the Halstead Reitan Battery is approximately a six-hour assessment of total neuropsychological functioning status of the individuals. Presented is the entire case study as was given to the medical team during this sabbatical.

Case Study

Name:	P.G.	Sex:	Male
Age:	28	Handedness:	Right
Education:	9	Occupation:	Prison inmate

Background Information

Approximately three years before the current evaluation, P.G. was struck on the head with an iron pipe. He was knocked unconscious but the exact duration of unconsciousness could not be determined. It was known, however, that he was stuporous for at least several days and was transferred from a local hospital to a major medical center for a more thorough evaluation. At that time, the patient had significant expressive aphasia; he was not able to talk but could follow simple commands. When he was transferred, he still had a large area of swelling of the left posterior parietal region.

Neurological Examination

Neurological examination revealed that the patient had a right facial weakness, a left pupil that was larger than the right pupil, and elevation of the left optic disc. Eight days after the injury, P. G. had not shown any improvement and, in fact, had evidence of increasing papilledema. the patient was taken to surgery and it was discovered that he

had a small subdural hematoma over the right cerebral hemisphere and an intracerebral hematoma in the left frontal area. The cerebral cortex in this area appeared to be contused and about 15 cc of hematoma was aspirated from the frontal lobe at a depth of about 1 cm. Following this procedure, P.G. showed gradual and uneventful improvement.

About three months after the injury, the patient began having epileptic seizures which were only partially controlled with medication. The clinical purpose of this present neurological evaluation was to determine if the seizures had affected his cognitive skills.

Neuropsychological Evaluation

This man showed a striking 40-point difference between Verbal (80) and Performance (120) intelligence levels. He performed quite poorly on the Digit Span (0) and Arithmetic (3) subtests of the Wechsler Scale and his scores were also somewhat below average on Information (7), Comprehension (9), and Vocabulary (8). Considering the fact that the patient had only a ninth-grade education, it seems likely that his Verbal intelligence was probably never well developed; nevertheless, a complete inability to perform the Digit Span subtest suggests that P.G. has experienced some type of impairment. The low Arithmetic score might possibly be related to lack of academic training, but it would also seem that some impairing factor had influenced this score as well.

P.G. did quite well on the Performance subtests, scoring above the average level on each subtest except Digit Symbol, although even on this subtest he earned a score of 10. Even though Digit Symbol had the lowest score of the Performance subtests, we would be disinclined to use this finding to substantiate a hypothesis of cerebral damage. The clinical basis for this interpretation centers on whether the score in question represents a normal performance for the individual involved; in this case it seems likely that an average score on Digit Symbol might well represent a normal performance for P.G.

In summary, the Wechsler results suggest that this man probably never had a particularly good educational background and, in addition, shows specific deficits on the Digit Span (and possibly Arithmetic) subtest. Although these results would not be inconsistent with left cerebral damage, they would hardly be an adequate basis for assuming that left cerebral damage was present (despite the 40-point different in favor of the Performance IQ).

The four most sensitive indicators in the HRNTB showed variability in level of performance. The Impairment Index, 0.4, is a borderline value. Part B of the Trail Making Test (1:07 sec) was done rather poorly, suggesting impaired cerebral functions. The Category Test (37) and the Localization component of the Tactual Performance Test (8)

were performed quite adequately. Thus, these results suggest that the patient does not have severe impairment of adaptive abilities and, considered independently, would hardly be sufficient to conclude that brain damage was present.

The next step in the analysis of the test results involves consideration of lateralizing findings. Although definitely right-handed, the patient's finger tapping speed was not quite as fast with his right hand (45) as his left (46) and he required slightly more time on the Tactile Form Recognition Test with his right hand (14) than his left (10). These findings involve both a motor (expressive) and tactile (receptive) deviation from normality and may have significance for left cerebral damage.

Results on the Aphasia Screening Test contributed further evidence of impairment. When asked to name the TRIANGLE, the patient responded "diamond." This particular response sometimes occurs among normal subjects and, by itself, cannot be used as an unequivocal indication of dysnomia. However, P.G.'s attempts to spell TRIANGLE definitely deviated from normal expectancy and did not represent the type of errors customarily seen in persons with low education. Therefore, we have to conclude that this spelling of TRIANGLE definitely raises the possibility of left cerebral damage.

Probably even more convincing evidence of cerebral

dysfunction was derived from P.G.'s response when he was asked to read 7 SIX 2. He failed to recognize that SIX represented either a word or a number and this type of error is frequently observed as a subtle manifestation of left cerebral dysfunction. The patient was not quite exact in his enunciation of MASSACHUSETTS and METHODIST EPISCOPAL, but the mistakes he made are the kid frequently seen among control subjects and have no significance for impaired brain functions.

Finally, when the patient attempted to write HE SHOUTED THE WARNING he made an error characteristic of brain-damaged persons in writing SHOUTED. Whether this is called dysgraphia or spelling dyspraxia may be open to question, but P.G>'s difficulty in using letters to form the word strengthened the hypothesis of left cerebral damage derived from spelling TRIANGLE. It is apparent from the patient's script that he has had the prior educational experience necessary to write simple words; therefore, lateralizing findings of significance for the left cerebral hemisphere included (1) somewhat slow finger tapping speed with the right hand; (2) mild slowness in tactile form recognition with the right hand; and (3) mild but definite errors on the Aphasia Test involving the use of language symbols for communicational purposes. Based on these findings we would conclude that this man shows evidence of mild dysphasia.

Other test results suggested mild impairment of right cerebral functions. Probably the most definite of these was seen in tactile finger localization. As shown by his performance with his right hand, the patient demonstrated that he had the basic abilities to do this task without error; however, he made three mistakes in 20 trials with the left hand. His grip strength was somewhat reduced in his left upper extremity (45 kg) compared with his right (55 kg) but this finding is probably not as convincing as the evidence of mild left finger dysgnosia. On the Tactual Performance Test the patient was also a little slow with his left hand (3.3 min) compared with his right (4.4 min) but we would classify this as the least significant of the three possibly indicators of right cerebral dysfunction. Taken together, however, they do suggest that the right cerebral hemisphere is probably mildly impaired.

One might also raise a question about P.G.'s drawings of simple figures. The second attempt to draw the cross represents the instance in which the patient came closest to demonstrating brain-related deficiencies, but considering the variation shown by normal subjects, attribution of right cerebral damage on the basis of these drawings would be questionable.

At this point one can summarize the test results on P.G. by noting that there was strong evidence of left cerebral

damage and mild evidence of right cerebral damage. These lateralizing results fell in the general context of a moderately poor score on Part B of the Trail Making Test, bilateral impairment in finger-tip number writing perception, and a 40-point disparity between Verbal and Performance IQ values. Even if limited educational background was responsible for lowered Verbal IQ, it would appear that left cerebral damage was also a contributing factor.

In summary, the test results suggest that this man has mild diffuse brain damage involving the left cerebral hemisphere to a greater extent than the right. There is certainly no basis for postulating a focal or progressive lesion of either cerebral hemisphere. In fact, the test results would be compatible with a relatively stabilized condition of the brain in a biological sense.

P.G.'s findings are quite characteristic of the long-term residual deficits of persons with head injuries. It is entirely likely that this man: (1) was considerably more impaired immediately after the injury was sustained that he was at the time of this testing; (2) has made an excellent recovery during the three years since the injury; and (3) is unlikely to show any further spontaneous recovery. Actually, considering the evidence of brain damage, it is surprising that P.G. performed as well as he did.

The right subdural hematoma may not have caused much

deficit, but the intracerebral hematoma of the left frontal area was associated with definite cerebral cortical damage. In addition, the blow to the head must have been quite substantial and we would have expected the patient to demonstrate evidence of more generalized cerebral damage. This case serves as an interesting example of the potential for spontaneous unassisted recovery of brain functions and demonstrates the manifestations of mild residual deficits.

THE HALSTEAD-REITAN NEUROPSYCHOLOGICAL TEST BATTERY

Patient P.G. Age 28 Sex M Education 9 Handedness R

WECHSLER-BELLEVUE SCALE

VIQ	80
PIQ	120
FS IQ	99
Information	7
Comprehension	9
Digit Span	0
Arithmetic	3
Similarities	11
Vocabulary	8
Picture Arrangement	13
Picture Completion	13
Block Design	15
Object Assembly	12
Digit Symbol	10

TRAIL MAKING TEST

Part A: 39 seconds
Part B: 107 seconds

STRENGTH OF GRIP

Dominant hand: 55 kilograms
Non-dominant hand: 45 kilograms

REITAN-KLØVE TACTILE FORM RECOGNITION TEST

Dominant hand: 14 seconds; 0 errors
Non-dominant hand: 10 seconds; 0 errors

REITAN-KLØVE SENSORY-PERCEPTUAL EXAM

		Error Totals
RH ___ LH ___	Both H: RH ___ LH ___	RH ___ LH ___
RH ___ LF ___	Both H/F: RH 1 LF ___	RH 1 LF ___
LH ___ RF ___	Both H/F: LH ___ RF ___	RF ___ LH ___
RE ___ LE ___	Both E: RE ___ LE ___	RE ___ LE ___
RV ___ LV ___	Both: RV ___ LV ___	RV ___ LV ___
___ ___	___ ___	
___ ___	___ ___	

TACTILE FINGER RECOGNITION

R 1 2 3 4 5 R 0 / 20
L 1 2 1 3 1 4 1 5 L 3 / 20

FINGER-TIP NUMBER WRITING

R 1 2 2 3 4 2 5 R 4 / 20
L 1 2 2 3 1 4 5 1 L 4 / 20

HALSTEAD'S NEUROPSYCHOLOGICAL TEST BATTERY

Category Test			37
Tactual Performance Test			
Dominant hand:	4.4		
Non-dominant hand:	3.3		
Both hands:	2.0		
		Total Time	9.7
		Memory	8
		Localization	8
Seashore Rhythm Test			
Number Correct	15		10
Speech-sounds Perception Test			
Number of Errors			12
Finger Oscillation Test			
Dominant hand:	45		45
Non-dominant hand:	46		
		Impairment Index	0.4

REITAN-KLØVE LATERAL-DOMINANCE EXAM

Show me how you:

throw a ball	R
hammer a nail	R
cut with a knife	R
turn a door knob	R
use scissors	R
use an eraser	R
write your name	R

Record time used for spontaneous name-writing:

Preferred hand	6 seconds
Non-preferred hand	14 seconds

Show me how you:

kick a football	R
step on a bug	R

He showed the warning

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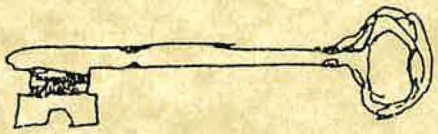

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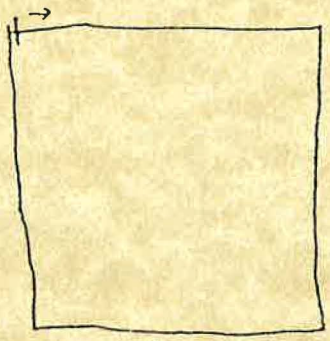

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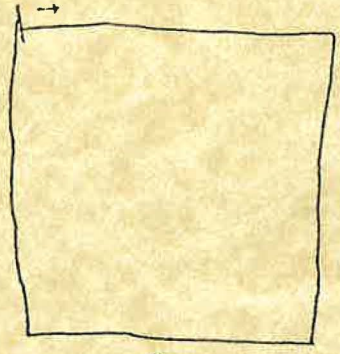

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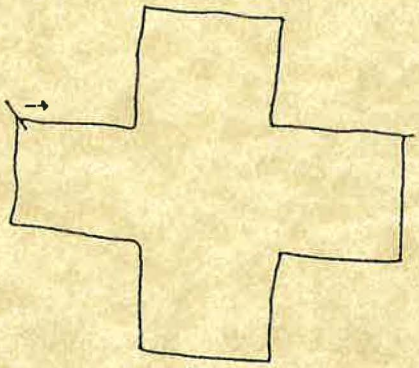

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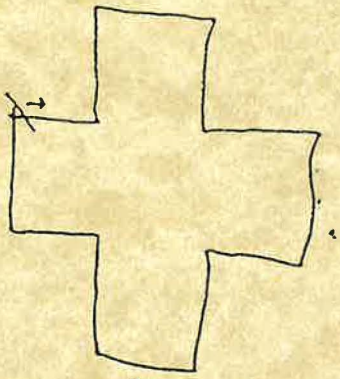

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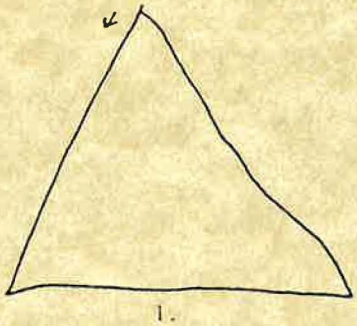

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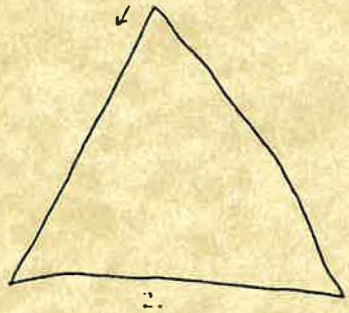

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Chapter V

College Visitations

During the course of this sabbatical, the writer had the opportunity of visiting several programs and agencies which cater to ABI individuals. The following is a synopsis of those programs and the mode of services rendered in each of those institutions.

Coastline Community College

Coastline is perhaps the only college that has developed a separate campus and program for acquired brain injured individuals. Their program is highly structured and has shown a high level of expectation and success, primarily because of the screening techniques utilized in this program.

The major difference between Coastline and other community college programs is that Coastline utilized a neuropsychological battery to assess each student before they are entered into the college program. Towards that end, they rely heavily upon the Reitan and Luria Nebraska model for assessment of each individual student. Although this is a long and cumbersome method, the students who are accepted in this program have shown a high level of success, primarily because of the stringent assessment techniques used by Coastline. Furthermore, this program used an extensive

background evaluation of the students as can be viewed from Appendix A.

The staff at Coastline consists of a director, neuropsychologist, counselor, career specialist, research specialist, job developer, and two full-time and eight part-time instructors. Interns in occupational therapy, social service, speech pathology, and counselors are utilized in this program. This is by far the most comprehensive of all programs that was visited by the writer.

Cerritos College

Cerritos College has an on and off campus program with sites at Rio Hondo Rehabilitation Hospital in Downey and a high tech program on campus. Students of ABI may either be inpatient or outpatient of the hospital. This program is open entry, offered on a non-credited basis.

The cognitive retraining is taught through modalities of computer technology. There are a number of different computer programs to improve student skills in reading, writing, spelling, comprehension, communication, and socialization skills.

The staff consists of one full-time speech pathologist, two computer technicians, and four teacher's assistants. There is a counselor attached to this program but on a part-time basis. As for evaluation and assessment, the program

does not have a formal evaluation but generally serves all ABI students.

Rancho Santiago Community College

Ranch Santiago (Santa Ana) has a new and large program for ABI students. Additionally, this program also services other individuals who are handicapped, such as the learning disabled.

The personnel of this program consist of two full-time speech pathologists, and two aides, who work 12 hours each, split among three different people. The equipment consists of three computers with several programs in the areas of communication, academics, and socialization. They have three modes of instruction within this program, those being tutorial, problem solving, and application, where the student is allowed to work independently. There is no formal evaluation of the student entering the program. However, there is ongoing evaluation of progress by the tutors and teachers with problem-solving skills being the most important acquisition of the ABI student.

Rancho Los Amigos

Rancho Los Amigos is a medical facility that caters to traumatic head injury people directly after the onset of the trauma. Thus, their evaluation is from a medical perspective

and is based upon the severity of injury and the probability for rehabilitation. If the claimant has a probability for rehabilitation and placement into the community, individuals at this facility undergo either the Reitan or Luria assessment battery. However, there is a pre-injury prediction for educational potential, neurological prediction for education potential, behavioral prediction for educational potential, and environmental prediction for educational potential, as can be viewed under Appendix B.

Casa Colina

Casa Colina is also a facility that caters to ABI claimants. It is based upon the same guidelines as Rancho with very little differences in their program. Case Colina has both an in- and out-patient program that is designed to work with in- or out-patient claimants. It also utilized the same predictive variables as can be viewed in Appendix B.

Clinical Facilities

The two training facilities utilized by this writer during the sabbatical was Inland Valley Neuropsychological Services and the Department of Rehabilitation. In both cases, this writer had the opportunity of utilizing all of the assessment devices to determine neuropsychological dysfunctioning. Both facilities treat a wide variety of

clients, with specialization of ABI claimants. The services from both facilities are free and without any pay from the acquired brain injured individual. Generally, the type of individuals who are treated at both facilities are those who are ready for cognitive and vocational rehabilitation.

Chapter VI

Assessment for College Competency

In visiting all of the above-mentioned programs, this writer had the opportunity of perusing a variety of different types of information, guidelines, equipment, and assessment devices utilized towards developing an ABI program. Of significant importance to any program is being able to accept students who have a good probability for success in such a program. Towards that end, this writer has attempted to develop some basic guidelines that should be utilized in the assessment of potential ABI students for college competency, specifically as it relates to Mt. SAC.

ABI is an acquired impairment, medically verifiable, brain functioning resulting in a loss or partial loss of one or more of the following psychological processes. They are: cognitive, communication, psychosocial, sensory perception, and academic skills. Therefore, in order to assure success in a college program, all of those areas need to be assessed by the staff of that program.

a. Cognitive - Impaired memory function, attention, concentration, judgment and problem solving, mental flexibility, organizational thinking skills, spatial orientation and information.

To assess for cognitive skills at the college level, the

following questions should be answered by perspective students:

_____ 1. Is able to take mainstream classes. May need academic counseling and/or registration assistance.

_____ 2. Is able to take mainstream classes, with consideration to number of classes and content areas.

_____ 3. May need a study skills/learning strategies class and monitoring. Orientation training may be needed to acquaint student with the campus.

_____ 4. May need cognitive retraining, i.e., concentration, reasoning, problem solving, orientation with the development of specific compensatory techniques for memory deficits in conjunction with mainstream special classes.

_____ 5. Requires cognitive retraining. Deficits restrict enrollment to specialized classes.

_____ 6. Benefits from cognitive retraining classes and special classes with consideration to the number of classes and content areas.

_____ 7. Requires cognitive retraining classes in a one-to-one or small group setting.

_____ 8. Limited benefit from community college activities.

_____ 9. Severity of involvement precludes benefit from attendance in a community college setting.

b. Communication - Impairment of speech, language and pragmatics (pragmatics is defined as the appropriate use of semantic and non-semantic rules governing communication).

To assess for communication skills at the college level, the following questions should be answered by perspective students.

_____ 1. Speech/language/communication is adequate for participation in mainstream classes.

_____ 2. Is able to take mainstream classes with consideration to content areas.

_____ 3. Is able to take mainstream classes with supplemental speech/language/communication services/or classes.

_____ 4. Is able to participate in selected mainstream classes and requires simultaneous speech/language/communication services/class in motor speech, receptive language, expressive language, and pragmatic communication.

_____ 5. Requires special speech/language/communication classes in addition to other special classes.

_____ 6. Benefits from speech/language/communication classes with consideration to complexity of content and instruction.

_____ 7. Benefits from small group instruction and tutoring in speech/language/communication.

_____ 8. Limited benefit from community college activities.

_____ 9. Severity of involvement precludes benefit from attendance in community college setting.

c. Psychosocial - Untoward social behavior or impaired psychodynamics that limit or impede learning, interpersonal relationships, coping strategies and goal-directed behavior.

To assess for psychosocial skills at the college level, the following questions should be answered by perspective students.

_____ 1. Psychosocial skills are adequate for participation in mainstream classes.

_____ 2. Is able to take mainstream classes but requires periodic counseling to monitor and modify behavior.

_____ 3. Is able to participate in mainstream classes with ongoing counseling and assistance in monitoring behavior.

_____ 4. Participates in selected mainstream and/or special classes. Requires ongoing counseling and structured intervention.

_____ 5. Participation is limited to special classes with ongoing counseling.

_____ 6. Benefits from special classes with one-to-one class assistance.

_____ 7. Is able to benefit only from a structured class addressing specific psychosocial issues or one-to-one instruction.

_____ 8. Limited benefit from community college activities.

_____ 9. Severity of involvement precludes benefit from attendance in a community college setting.

d. Sensory/perceptual - Deficiencies in primary perceptual systems such as visual, auditory and tactile.

To assess for sensory/perceptual skills at the college level, the following questions should be answered by perspective students.

_____ 1. Psychomotor skills are adequate to participate in mainstream classes. May need academic counseling and/or registration assistance.

_____ 2. May have mild limitations in psychomotor domain, but functions independently. May require minimal support.

_____ 3. Is capable of satisfactorily meeting the criterion of a mainstream class with adaptation and/or assistance.

_____ 4. Benefits from participation in psychomotor training which may include adaptive physical education, and/or sensory motor re-education with compensatory techniques for participation in mainstream and/or special classes.

_____ 5. Requires supervision and assistance to benefit from adaptive physical education and sensory motor classes.

_____ 6. Requires one-to-one assistance to benefit from specialized psychomotor classes.

_____ 7. Requires a specialized approach to relearning psychomotor skills in a one-to-one setting.

_____ 8. Limited benefit from community college activities.

_____ 9. Severity of involvement precludes benefit from attendance in community college setting.

e. Academic - Impaired skills in the basic processes of reading, writing, and computational skills.

To assess for academic skills at the college level, the following questions should be answered by perspective students.

_____ 1. Academic skills are adequate to take mainstream classes without assistance. May need academic counseling and/or registration assistance.

_____ 2. Is able to take mainstream classes with supportive services.

_____ 3. Is able to take mainstream classes with supportive services, the assistance of a tutor and/or a study skills/learning strategies class.

_____ 4. Is able to participate in some selected mainstream classes but requires special classes in basic academic skills such as reading, spelling, math, or writing.

_____ 5. Participation is restricted to special academic classes.

_____ 6. Benefits from special academic classes with assistance of a tutor.

_____ 7. Benefits from one-to-one tutoring.

_____ 8. Limited benefit from community college activities.

_____ 9. Severity of involvement precludes benefit from attendance in a community college setting.

Appendix C is a visual analysis of the assessment of a student in the major areas of functioning. In particular, this form allows one to assess from the mild to severe level of functioning in the cognition, communication, psychosocial, academic, and psychomotor arenas. Further, it provides a visual analysis to determine the probability of success in either of the above-mentioned areas.

Appendix D provides a method of screening students to determine their basic probability for success in a college program.

Appendix E presents the examiner's immediate perception of that student, while Appendix F presents a form of tracking the student's level of success while enrolled in an ABI program. Moreover, Appendix G provides a method of determining how students should enter and exit from ABI programs.

Merits, Values to Instructional and Service Areas of Mt. SAC

The anticipated values of this sabbatical provided the opportunity for this writer to increase his knowledge in a

relatively new and complicated field within higher education.

More specifically, it offered a chance to learn cognitive style and instructional strategies for ABI students. Specifically, it gave this writer the opportunity to learn the services that are rendered at other colleges, the assessment techniques that are used, and the evaluation model that is needed in developing a good ABI program. Moreover, it allowed this writer the opportunity to learn a new set of skills in the specific techniques of assessing ABI students towards learning specific areas of dysfunctioning which could increase the probabilities of success in a college program.

It is anticipated with a great deal of pleasure that the uniqueness of being able to be precise in identifying cognitive dysfunctioning will allow the instructional staff, through in-service training to be better aware of the various methods of teaching and identifying students with ABIs. It is also anticipated that sharing the gained knowledge of awareness with administrators, teachers, and counseling staff will heighten their knowledge of ABI through this writer's experiences. Moreover, it is hopeful that the new knowledge will provide a greater willingness to work towards developing a comprehensive program for ABI students at Mt. SAC.

The secondary value of the sabbatical has allowed this writer to increase his knowledge and intellectual curiosity

on brain dysfunctioning. In particular, this sabbatical provided a unique opportunity for this writer to work with many of the top neuropsychologists in the educational field. Furthermore, it allowed for the learning of new skills in the assessment of ABI students. Moreover, it gave this writer the opportunity of learning the subtle differences needed in making a comprehensive diagnosis of ABI claimants and identifying specific areas of behavioral and cognitive dysfunctioning. For this opportunity, I am deeply grateful and indebted to the many individuals at various colleges and clinical settings that I had the opportunity to work with over the past six months.

Chapter VII

Conclusions and Recommendations

Conclusions

This sabbatical project provided an opportunity for me to investigate a very specialized population, which has great significance for program and services for disabled students at Mt. SAC. The knowledge gleaned from this experience will be shared and expanded to enhance services for the acquired brain injured individuals at this institution. It is anticipated that, in time, plans may be developed and implemented for a more specialized program to serve this population.

I am deeply grateful for the confidence that my immediate supervisors, chief administrative officer of the college, management leave committee, and Board of Trustees had in me for allowing this opportunity to enrich my professional expertise in a new exciting field. I look forward to sharing this information and my recommendations for Mt. SAC to each and every one of you.

Recommendations

1. It is strongly recommended that Mt. SAC establish a program for the acquired brain injured.
2. If such a program is acquired, it is further suggested

that it coincide with the established program within the community college system. In particular, it is suggested that the program is geared under the auspices of a high-tech program with the use of computers for the acquired brain injured.

3. Staffing patterns at Mt. SAC in the high tech center should reflect training in speech, communication, cognitive processes and the neuropsychological process of learning.

4. Perhaps the most important goal of any program is the selection of successful students. In view of the large number of students who experience head injuries, a guideline should be established towards evaluating these students prior to placement into this program.

In light of this, the following recommendations are offered:

A. It is strongly suggested that a nine-week mini-course be established on the orientation and assessment of the brain injured. This course would serve as a vehicle to screen potential students for Mt. SAC's program.

B. The nine-week course would allow students to undergo various aspects of evaluation from an academic, social, psychological, motoric, and behavioralistic mode to determine the suitability for placement in a college-

level program.

C. This class would also allow the opportunity of developing a profile of these student so that a curriculum could be used to facilitate their training and advancement at Mt. SAC.

D. It is further recommended that this class be designed on a similar model to Learn 60 being utilized for students with learning disabilities. More specifically, this should be a one unit, non-degreed appropriate class over a nine-week period.

E. Students who progress through the orientation and assessment class and are accepted into the Acquired Brain Injured Program should be allowed to remain in the program for at least two full semesters. Upon completion of two full semesters in the program, these students should be evaluated by the staff to determine the feasibility of moving into regular college-level classes. If students after one year have not made adequate progress, an individual evaluation should be rendered to determine the feasibility of them remaining in the ABI Program.

F. It is strongly recommended that establishment of a liaison between Mt. SAC Disabled Center and outside agencies with possible referral of students being made to the Disabled Center to insure success of the program.

APPENDICES

Appendix A

Appendix B

Pre-Injury Predictors of Educational Potential and Outcome from Head Trauma

GOOD POTENTIAL AND OUTCOME +	- POOR POTENTIAL AND OUTCOME
1. History of good achievement	1. History of poor achievement
2. Good social relationships	2. Poor social relationships
3. No history of learning difficulties	3. History of learning difficulties
4. High intelligence (IQ)	4. Low intelligence (IQ)
5. Good academic history	5. Poor academic history
6. No history of substance abuse	6. History of substance abuse
7. No criminal history	7. Criminal history
8. Good character and self-control	8. Poor character and impulsive problems
9. Good relationship with family	9. Poor relationship with family
10. Warm and supportive family	10. Cold and rejecting family
11. Intact family	11. Broken family
12. Good emotional/personality adjustment	12. Poor emotional/personality adjustment
13. Strong-willed and determined	13. Tendencies to give up easily
14. Under 21 years of age	14. Over 35 years of age
15. Similar pre-injury/post-injury vocational abilities	15. Wide gap in pre-injury/post-injury vocational abilities

16. No previous brain insult	16. History of previous brain insult

	+	-
TOTAL		

Neurological Predictors of Educational Potential and Outcome from Head Trauma

GOOD POTENTIAL AND OUTCOME	+	-	POOR POTENTIAL AND OUTCOME
1. Coma less than six hours			1. Coma greater than 30 days
2. Post-traumatic amnesia (confusion) less than 24 hours			2. Post-traumatic amnesia (confusion) greater then 30 days
3. Glasgow Coma Scale greater than seven			3. Glasgow Coma Scale less than five
4. Localized brain damage			4. Diffuse brain damage
5. Normal intracranial pressure			5. Elevated intracranial pressure
6. Normal ventricle size			6. Enlarged ventricles
7. No intracranial hematoma			7. Intracranial hematoma
8. No brain swelling (edema)			8. Brain swelling (edema)
9. No intracranial infection			9. Intracranial infection
10. No post-traumatic seizure disorder			10. Post-traumatic epilepsy
11. No hypoxia/anoxia damage			11. Hypoxic/anoxic brain
12. Depressed skull fracture on impact			12. Severe closed head insult on impact
13. No psychotropic medications			13. Dependent on psychotropic medications
14. No anti-convulsant medications			14. Dependent on anti-seizure medications
15. Fast rate of recovery of functions			15. Slow rate of recovery of functions
	+	-	
TOTAL			

Behavioral Predictors of Educational Potential and Outcome from Head Trauma

GOOD POTENTIAL AND OUTCOME +	- POOR POTENTIAL AND OUTCOME
1. Motivated and goal-oriented	1. Unmotivated with no goals
2. Able to recognize errors	2. Unable to recognize errors
3. Aware of behavioral deficits	3. Unable to recognize deficits with denial of disability
4. Persistent	4. Gives up easily
5. Ambulatory	5. Not ambulatory
6. Good judgment and reasoning skills	6. Poor judgment and reasoning skills
7. Mentally flexible	7. Rigid and perseverative
8. Independent in self-care	8. Dependent on others for self-care
9. Intact perceptual skills	9. Poor perceptual skills
10. Initiates tasks independently	10. Cannot initiate tasks independently
11. Concerned for others	11. Self-centered and ego-centric
12. Few failures	12. Many failures
13. Active and/or agitated	13. Inactive and/or apathetic
14. Mild recent memory deficits	14. Severe recent memory deficits
15. Mild "catastrophic reaction"	15. Severe "catastrophic reaction"
16. Optimistic	16. Discouraged
17. Good communication skills	17. Poor communication skills

18. Good planning skills	18. Poor planning skills
19. Fast speed of thinking	19. Slow speed of thinking

	+	-
TOTAL		

Environmental Predictors of Educational Potential and Outcome from Head Trauma

GOOD POTENTIAL AND OUTCOME	+ -	POOR POTENTIAL AND OUTCOME
1. Presence of "key person" in family		1. No "key person" in family
2. Family involved in team treatment		2. Family not involved
3. Family supportive and accepting of patient and team		3. Family not supportive and accepting of patient and team
4. Family realistic about patient's deficits and outcome		4. Family unrealistic about patient's deficits and outcome
5. Interdisciplinary team treatment		5. Multidisciplinary team treatment
6. Presence of "key person" on staff		6. No "key person" on staff
7. Treatment goals appropriate to expected long-term outcome		7. Treatment goals inappropriate to expected long-term outcome
8. Individual treatment plans		8. No individual treatment plans
9. Continuity and coordination of treatment through stages of recovery		9. No continuity and coordination of treatment through stages of recovery
10. Structure, consistency, and repetition in daily activities		10. Unstructured, erratic, and non-repeated daily activities
11. Success-producing environment		11. Failure-producing environment
12. Good financial/insurance resources		12. Poor financial/ insurance resources
13. Lots of rewards for successful progress		13. Few rewards for successful progress

14. Presence of support group and community resources for family and patient	14. No support group or community resources for family and patient

\+ -

TOTAL _____

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