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Personality variables associated with post-traumatic adjustment following closed head injury

Hunt, Meleesa Anne, Ph.D.
The Ohio State University, 1988
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UMI
PERSONALITY VARIABLES ASSOCIATED WITH POST-TRAUMATIC
ADJUSTMENT FOLLOWING CLOSED HEAD INJURY

DISSEPTION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Meleesa A. Hunt, B.A., M.A.

The Ohio State University

1988

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CHAPTER I
INTRODUCTION

It has long been recognized that traumatic brain injury can result in a constellation of psychological sequelae which can be predicted or anticipated on the basis of the location and severity of the damage (Jennett, Snoek, Bond, & Brooks, 1981; Rimel, Giordani, Barth, Boll, & Jane, 1981; Rimel, Giordani, Barth, & Jane, 1982).

Identifiable patterns of cognitive, affective, and behavioral changes are often observed among individuals who have suffered similar types of damage. In fact, the routine emergence of classic deficits is so compelling that it may at times obscure the role of individual differences in determining personality following head injury. The field of neuropsychological assessment is built on the premise that certain brain/behavior relationships exist. A disturbance in observed function can be equated with some particular aspect of organic damage. The nature of the damage is frequently inferred from the specific pattern of functional deficits, particularly when the damage is either too subtle or too diffuse to be adequately described by diagnostic medical technology. Once the patient has been categorized as suffering from one type of damage as opposed to another, it may
become tempting to view subsequent behaviors as manifestations of the diagnosed condition. It might be argued that, as with any labeling process, there is a danger of creating a selective observation bias and a set of predetermined expectations which may influence the patient's behavior or the perception of progress.

While it remains clear that certain types of brain damage may give rise to characteristic sets of psychological sequelae, care must be taken not to oversimplify those relationships. Factors other than the location and extent of damage are crucial in determining outcome. Age at the time of injury is one such mediating variable. As Rutter (1982) observes, "...it is not just whether it is better or worse to have your brain lesion early; rather, it concerns the age-related neuropathological and psychological processes involved in the disabilities and the recovery that may follow different forms of brain injury at different phases of the developmental cycle" (Rutter, 1982, p. 108).

Vygotsky's (1986) theory of interfunctional relations in regard to higher mental processes such as concept formation predicts the generalized decrease in overall learning ability which occurs when structures are damaged at an early stage of development (Chadwick & Rutter, 1982). Vygotsky proposes a developmental model which emphasizes the reciprocal embeddedness of thought and language. At the most primitive level of development, thought and language evolve separately until they become united in the most basic unit of symbolic representation—a
phoneme, or a word attached to meaning. Higher mental processes are, in Vygotsky's view, dependent upon these basic signs which, at varying stages of biological and socio-cultural ontogenesis, embody concepts of increasing complexity as the maturation of thought and language proceed in concert. If the underlying neural components of this process are disrupted, the ability to think, in general, will be altered. Even when phonemes are phenotypically alike, their phenomenological meanings will be limited to the level of conceptualization possible given the injury.

Luria's (1973) model of hierarchical functional systems in the brain introduces yet another problem for simplistic formulations relating observed damage to expected outcome. Luria proposes three functional units as follows:

Unit I, for regulation of arousal, alertness, and "cortical tone" (corresponding to subcortical structures such as the brain stem, the limbic system, and the reticular activating system).
Unit II, for obtaining, processing, and storing information especially with regard to sensory-motoric input (corresponding to the occipital, temporal, and parietal lobes).
Unit III, for the organizing or "executive functions" of programming, regulating, and verifying overt behavior and mental activity (corresponding to the frontal lobes and especially the prefrontal areas known as the granular frontal cortex).
These units are not only arranged hierarchically among themselves, they each contain sub-units (primary, secondary, and tertiary zones) which are also hierarchically related. The tertiary zones of each unit are involved in the complex interlinking processes which allow all three units to work together in synchronicity. It is important to emphasize, as Luria puts it, that "Each form of conscious activity is always a complex functional system and takes place through the combined working of all three brain units, each of which makes its own contribution" (Luria, 1973, p. 99). Given the interactional qualities of this system, it is apparent that damage in one area may give rise to changes and potential deficits in many other areas of the brain.

The purpose of this study is not to refute established research which has substantiated certain brain-behavior relationships. Rather, it is the purpose of this study to explore additional factors associated with residual personality traits which may also play a significant role in the patient's cognitive, emotional, and behavioral status post-injury.

The questions posed in this study refer directly to a specifically defined population of head-injured persons and their families. Therefore, a review of related literature will focus primarily on the specifics of traumatic brain injury and subsequent rehabilitation efforts. However, it should be briefly noted that the theoretical underpinnings of this project reflect a broader perspective entailing general concepts such as adjustment, adaptation, and individual differences.
A basic premise of this study is to focus on the individual within the interactive context of his or her environment. For this reason, we are not examining personality traits in isolation. Instead, personality factors are juxtaposed with functional, behavioral, and environmentally determined measures to create a picture of how the person is readjusting. Since the head-injured person's primary interactions occur within the climate of interpersonal relationships between themselves and their most significant others, the personality traits of the significant others are, in turn, a component of the injured person's environments.

Vygotsky (1986) protests against compartmentalization of thought and feeling, arguing instead that a good model should allow for the reciprocal influence of thought on affect and volition, and vice versa. In his holistic view, "every idea contains a transmuted affective attitude toward the bit of reality to which it refers", and, as he goes on to say "...we can trace a path from a person's needs and impulses to the specific direction taken by his thoughts and the reverse path from his thoughts to his behavior and ability" (Vygotsky, 1986, p. 10-11). In a similar context, Mooney's "self-in-situation" model (1963) which was further extended by Tosi (1974), describes a person as thinking, feeling, and acting within a socio-cultural system. The environment is defined as all the possible contacts or situations persons encounter in their daily lives. The model emphasizes that the individual does not operate in a vacuum. It also posits an
interplay between cognitive-affective states and behavior. Persons not only think, feel, and act in relationship to their phenomenological external environment, they also respond to the dynamic interweaving of their internal or personal processes. Of course, in any interaction involving two people, the situation encompasses both individual's external environments as well as both person's internal processes. Even at this simple level of explication, it becomes apparent that any individual's adjustment to an environment entails a complexity of innumerable permutations and possibilities. These factors are further complicated by the presence of an injury which may compromise the function of one or more of the internal processes, thus affecting, in turn, the other internal functions as well as impacting upon relationships outside the self.

In a longitudinal study conducted in a remote region of the Soviet Union, Luria (1976) offers convincing evidence that basic cognitive processes such as perception, generalization and abstraction, deduction and inference, reasoning and problem-solving, imagination, and self-analysis/self-awareness are significantly altered by the socio-historical development of a given culture. As he states it, "The basic categories of human mental life can be understood as products of social history and they are subject to change when the basic forms of social practice are altered and thus are social in nature" (Luria, 1976, p. 164). In other words, the general nature and level of cognitive processing among representative members of a given culture evolves
along with that culture. Thus we find persons in highly evolved, technological or industrialized settings, equipped with the basic cognitive skills required for those settings. The synchronicity of cultural demands giving rise to the development of cognitive capabilities makes for a smoother fit between the individual and society. Starting from this perspective, consider the head-injured person, whose basic levels of cognitive processing have been notably diminished by the insult. This person will certainly encounter specific difficulties related to these deficits (e.g., memory loss, inability to generalize, difficulty with new learning). However, perhaps even more important and pervasive will be the general difficulty he or she may experience as a result of being suddenly out of sync with his or her entire culture. Through injury, the person has abruptly lost access to much of the legacy of collective socio-historical development which had previously served as a substrate for his or her own, individual style of mental processing. Of course, the extent of this loss is dependent upon the severity of the injury. However, in a complex society such as ours, even moderate impairment in areas such as self-awareness and self-analysis can result in social/interpersonal problems and a sense of being "misfit".

Each head-injured person approaches the predicament of readjusting to his or her interpersonal environment and to society at large in a unique manner. Lazarus (1976) describes personality as "the stable psychological characteristics of the individual
that dispose him or her to deal with situations in certain distinctive ways. (He goes on to make the strong statement that)

. . . in short, personality and adjustment are totally interrelated subjects of study. They are two sides of the same coin and it is really impossible to speak of one without the other" (Lazarus, 1976, p. 17). In his view, the characteristic ways in which a person adjusts to various life situations can, in themselves, be viewed as personality traits. Allport (1937) in his classic definition of personality, also draws the connection between personality and adjustment: "Personality is the dynamic organization within the individual of those psycho-social systems that determine his unique adjustments to his environment" (Allport, 1937, p. 48).

Much of the research thrust in applied neuropsychology for the head-injured population has been directed toward developing intervention strategies to remediate cognitive deficits (Diller & Gordon, 1981; Gianutsos & Gianutsos, 1979). Investigation of psychosocial outcome including some attention to personality variables, has also been popular (Bond & McKinlay, 1983). However, the primary focus of research on personality characteristics has been to catalogue and substantiate the "personality changes" and associated behavioral aberrations which occur among head-injured patients. Much less emphasis has been given to examining the post-morbid personality structure as a valid entity in and of itself without special regard for exactly which elements of personality can be identified as "pre-morbid"
and which can be directly attributed to the effects of the injury. While the extent of personality change is an interesting and important dimension, current personality status may be an even more salient factor. The value in more clearly explicating the role of personality in post-traumatic adjustment would be to establish therapeutic interventions which address existing personality dynamics as well as the specific emotional and behavioral sequelae resulting from the injury.

The head-injured patient's eventual level of post-traumatic adjustment will be determined by his or her ability to cope with the demands of his physical and interpersonal environment given the limitations imposed by the effects of injury (Sbordone, 1984). For most head-injured patients, the interpersonal environment includes the presence of one primary significant other, generally a spouse or parent, who assumes a care-giving role throughout the acute phases of injury and a supportive role as rehabilitation progresses. Because of the intimate association between the head-injured patient and the significant other, the personality characteristics of the significant other become a central feature of the head-injured patient's daily existence. As such, examination of personality traits among significant others should serve to augment information obtained in investigating the role of personality traits of head-injured patients as related to post-traumatic adjustment status. Comparative behavior ratings are frequently sought from these significant others in the more traditional studies of "personality change" previously cited.
Yet, as McKinlay and Brooks (1984) point out, the significant others' perceptions of the head-injured person's status are almost certainly affected to some degree by their own personal orientations. McKinlay and Brooks express concern that, to date, little is known about how personality characteristics of the significant other influence data gathered on the head-injured patient.

**Purpose**

The purpose of this study will be two-fold:

a. To investigate the role of personality variables among head-injured patients in relationship to post-traumatic adjustment level.

b. To investigate the role of personality variables among the significant others of head-injured patients as related to the post-traumatic adjustment level of the head-injured patient.

Personality will be measured by the Minnesota Multiphasic Personality Inventory (MMPI) (Hathaway & McKinley, 1943) and the OBD-168 (Sbordone & Caldwell, 1979). Adjustment will be measured via the Functional Assessment Inventory (FAI) (Crewe & Athelstan, 1984) and the Sickness Impact Profile (SIP) (Department of Health Services, University of Washington, 1977).
Hypotheses

The questions to be researched are as follows:

1. Will the High-adjusting group of head-injured patients (HI-hi) differ significantly from the low-adjusting group of head-injured patients (HI-lo) on one or more personality variables when "level of adjustment" is determined by professional ratings?

2. Will the High-adjusting group of head-injured patients (HI-hi) differ significantly from the low-adjusting group of head-injured patients (HI-lo) on one or more personality variables when "level of adjustment" is determined by self-ratings?

3. Will the High-adjusting group of head-injured patients (HI-hi) differ significantly from the low-adjusting group of head-injured patients (HI-lo) on one or more personality variables when "level of adjustment" is determined by significant other ratings?

4. When "level of adjustment" is determined by professional ratings, will the significant others associated with high-adjusting head-injured patients (SO-hi) differ significantly from the significant others associated with low-adjusting head-injured patients (SO-lo) on one or more personality variables?

5. When "level of adjustment" is determined by ratings of the head-injured person himself (self-ratings), will the
significant others associated with high-adjusting head-injured patients (SO-hi) differ significantly from the significant others associated with low-adjusting head-injured patients (SO-lo) on one or more personality variables?

6. When "level of adjustment" is determined by ratings of the significant other himself (significant other ratings), will the significant others associated with high-adjusting head-injured persons (SO-hi) differ significantly from the significant others associated with the low-adjusting head-injured patients (SO-lo) on one or more personality variables?

Definitions

Personality - For the purposes of this study, personality will be defined as the traits reflected on the ten clinical scales of the Minnesota Multiphasic Personality Inventory (MMPI) for significant others and the ten clinical scales of the OBD-168 (Appendix A) for the head-injured persons.

Adjustment - For the purposes of this study, level of adjustment will be defined in three ways:

- "professional assessment" level of adjustment will be defined as the score on the Functional Assessment Inventory (FAI) (Appendix B).
"significant other assessment" of level of adjustment will be defined as the score on the Sickness Impact Profile (SIP) (Appendix C) when completed by the designated significant other.

"self-assessment" of level of adjustment will be defined as the score on the Sickness Impact Profile (SIP) when completed by the head-injured person himself or herself.

Closed Head Injury - For the purposes of this study, closed head injury will be defined as a non-penetrating insult to the brain resulting in loss of consciousness for six hours or more.

Significant Other - For the purposes of this study, the significant other is the person identified as being most closely associated with the head-injured individual.

Identification of significant other is made by the head-injured person with corroboration from the family member and/or associated professionals.
CHAPTER II
REVIEW OF LITERATURE

Initially, this chapter will provide a basic framework for understanding the topic of closed head injury in general by reviewing current theoretical viewpoints and empirical findings. Later sections will deal more specifically with the psychological sequelae of head injury, including the role of personality variables and the ramifications of injury within the family system.

Neural Substrates of Closed Head Injury

It might be said that head injuries are something like snowflakes - no two injuries can ever be exactly alike. Given the intricacies of the human brain, no two brains are likely to be identical even without introducing the prospect of damage. Once the brain has been compromised, the resulting permutations defy quantification. At the simplest level, the precise neuronal damage must be considered. At the next order of complexity, the interactional consequences of this damage vis a vis the overall neural network in the brain become salient. As this discussion proceeds to delineate various general classifications of damage associated with concomitant clinical manifestations, it is wise to
maintain a sense of perspective, realizing that while such categorization is practical, parsimonious, and of heuristic value, it cannot be regarded as absolute.

The diagnostic term "closed head injury" (CHI) does not represent a unitary concept. As a subcategory of traumatic brain injury, CHI is distinguished from penetrating, open, or missile-induced head injuries, skull fractures, hypoxia, and ischemic damage. However, the CHI subcategory, itself, must then be further divided to adequately describe the etiological and symptomological differences among the varying forms of CHI. Basic dimensions to be considered are the severity of the injury (mild, moderate, or severe) and the patterns of damage (focal or diffuse).

Focal Lesions

Focal lesions are typically the result of sudden, direct impact of short duration (Adamovich, Henderson, & Auerbach, 1985). The biomechanical forces involved are primarily translational or linear as opposed to rotational (Ommaya, Hirsch, Flamm, & Mahone, 1966). Common precipitating events include blows to the head and "simple falls". Doyle, Graham, Lawrence, and McLellan (1984) demonstrated that "simple falls" (not more than a person's own height) resulted in discrete cortical damage whereas falls of increasing distance were associated with more diffuse, nonspecific brain injury. Focal lesions rarely produce loss of consciousness
unless secondary complications such as swelling of the brain ensue. Cortical damage occurs in the form of cerebral contusions or bruises over the surface of the brain, arising in predictable, characteristic patterns which are relatively independent of the actual site of injury (Auerbach, 1986). In fact, the areas of damage relate more specifically to morphological features of the brain and the cranium. As Lezak (1983) describes the process, the initial force of the impact (coup) sets the brain in motion consistent with the direction of that force, causing the brain to "bounce back" against the opposite or contralateral portion of the skull (contrecoup). Contusions may be sustained in both the coup and contrecoup areas, with the contrecoup injury frequently being more severe. Contusions are most commonly observed in the frontal and temporal regions regardless of the exact point of impact. Bony protrusions of the skull in these areas account for the increased possibility of bruising and scraping. The occipital lobes are less frequently affected due to the comparatively smooth quality of the occipital bones and the tentorium (Adams & Victor, 1981). A more detailed description of characteristic damage can be provided as follows:

In the frontal lobes, the polar and inferior or orbitofrontal surfaces are affected with sparing of the dorsolateral surface. In the case of the temporal lobes, the anterior or polar surface as well as the lateral and inferior surfaces are affected. Of special note is that the medial temporal surface, often implicated in memory function, is generally not involved in this type of injury. (Auerbach, 1986, p. 2)
Focal damage is discrete and regionally specific in contrast to the diffuse and pervasive pattern of axonal injury characteristic of moderate and severe head injury. However, in some respects, the term "focal" can be misleading. Focal damage is directly identified with the point of primary insult. However, this initial lesion may precipitate indirect, far-reaching physiological changes in other parts of the brain. For example, Morrison, Molliver, and Grzanna (1979) examined the patterns of noradrenergic projections (NA) in the cerebral cortex of rats. They found that this dense and diverse network of innervation, thought to mediate functions such as attention, mood, and awareness, was arranged in a longitudinal, rostral to caudal fashion. Ascending fibers originating in the pons and entering the cortex at the frontal pole, branch out to innervate an entire lateral layer of cortex from the frontal lobe to the occipital lobe. Because this NA system extends longitudinally throughout the entire hemisphere, a very small, localized lesion of the frontal pole where the fibers enter the cortex can give rise to generalized and widespread damage with marked neurobehavioral consequences. The above described instance represents just one example of how focal injuries can produce more general deficits.

**Diffuse Axonal Injury**

The other type of damage characteristic of closed head injuries is diffuse axonal injury (DAI). DAI is the result of rotational forces which may or may not occur in conjunction with
linear or translational forces. These forces are often generated without direct impact, arising instead from high velocity acceleration-deceleration sequences such as frequently occur in motor vehicle accidents (Adams, Graham, & Murray, 1982). The brain, suspended and typically protected within the skull in a somewhat vitrious environment, continues momentarily to accelerate with the velocity of the initial propelling force in a vector corresponding to a shift in the center of gravity induced by movement of the head. When the brain encounters the static barrier of the skull which is no longer in motion, it is deflected, thus setting up powerful shearing forces.

Anatomical factors accentuate this process in that (a) the human head, positioned atop the much narrower neck, moves freely and rarely remains static in response to a dynamic event; (b) the human brain is composed of two comparatively large hemispheres atop a much narrower brain stem. Again, the tendency to rotate is increased by this construction. It is theorized that these rotational forces occur centripetally, with outer or surface portions of the brain being affected first (subjected to greater initial force) and inner or medial structures in the brain being affected last. In support of this theory, primary brain stem injury has not been found to occur without accompanying diffuse damage in other areas (Mitchell & Hume-Adams, 1975; Reilly, Graham, & Hume-Adams, 1975). It has also been demonstrated that
the severity of mid-brain lesions predicts the severity of overall diffuse axonal damage (Gennarelli, Thibault, Adams et al., 1982).

May, Fuster, Haber, and Hirschman (1979) offer an interesting analogue study looking at the high impact and deceleration velocities of drilling behavior in woodpeckers. Solely from a biophysical perspective, repetitions of this type with such relative force might be expected to cause intracranial damage. These researchers were able to confirm that the drilling trajectory is strictly linear and that the bird's head is laterally immobilized. Rotational forces are not present. They hypothesize that this protective mechanism may have developed through natural selection. Ommaya and Gennarelli (1974) controlled rotational head movement in primates with an apparatus composed of a restraining helmet and stabilizing linkages. They found that when the animal's head was prevented from rotating in any vector, concussion did not occur, even when translational forces exceeded 1000 g. As might be predicted, however, focal lesions in the classic patterns as described earlier in this section were observed. With rotational forces uncontrolled, forces as low as 348 g. produced concussion and diffuse axonal injury. Auerbach (1986) describes DAI as subsuming a triad of typical features as follows:

- microscopic evidence of diffuse damage to axons, especially in the parasagittal and midbrain areas; focal lesions of the corpus callosum; focal lesions in the dorsolateral quadrant of the rostral brain stem in the area of the superior cerebellar peduncles. (Auerbach, 1986, p. 4)
Lesions of the corpus callosum and at the rostral brain stem are attributed to the particular weakness or vulnerability to stress of areas where separate masses of brain tissue are joined. Predominance of DAI in the rostral brain stem is consistent with the view that loss of consciousness or coma in closed head injury occurs secondary to sudden disruption of the reticular activating system in the brain stem (Lezak, 1983). The immediate changes in blood pressure, pulse rate, and respiration diagnostic of concussion also signal brain stem dysfunction (Rosenthal, Griffith, Bond, & Miller, 1983).

DAI is implicated in virtually all cases of moderate and severe head injury which, by definition, entail loss of consciousness (Denny-Brown & Russell, 1941; Strich, 1961). More recently, Jane, Steward, and Gennarelli (1985) have demonstrated that DAI may also be a factor in minor head injury. They subjected primates to a non-impact, acceleration-deceleration injury sufficient to cause only brief loss of consciousness and resulting in no observable sequelae. Upon autopsy, axonal injury was identified in the inferior colliculus, the pons, and the dorsolateral medulla (brain stem structures).

The shearing forces of rotational injuries may actually break neural fibers (axonatomy) or, under less intense stress, may cause sufficient strain on the axon to alter its function without damaging its structure. In such cases, it is theorized that the membrane potential of the neuron becomes depolarized, rendering it
incapable of transmitting an electrical impulse (Gennarelli, 1986). Axonal strain is thought to be transient. Kelly (1985) details the effect of injury on neurons. When an axon is cut, both the distal and proximal segments lose axoplasm, retract from each other, swell, and seal themselves off, creating "retraction bulbs" on each of the severed ends. The distal segment, cut off from its metabolic link to the cell body, may fail to transmit signals within hours of the injury. Within two weeks, the synapses previously formed by the distal segment are completely absent (terminal degeneration). The axon itself degenerates within one or two months (Wallerian degeneration). Terminal degeneration may cause transneuronal degeneration in pre-synaptic and/or post-synaptic cells which, prior to injury, received signals from or gave signals to the affected cell. Thus, a "domino" effect is created such that destruction of one neuron can lead to degeneration of numerous other neurons.

Another reaction of the nervous system to injury involves the rapid dispatch of glial cells to the site of injury. These glial cells are phagocytes, designed to clean up the debris of degeneration. However, in the central nervous system, they also interfere with potential recovery of function by creating dense patches or "stars" of scar tissue. Lesions of this type have been found to be prominent in microscopic investigations of brain tissue following head injury (Oppenheimer, 1968).
Descriptive Classification of Closed Head Injuries

Definitions and Assessment Techniques

Closed head injuries are typically classified according to their severity at the time of the initial insult. One of the most widely utilized set of criteria specifies minor head injuries as those entailing 0 - 20 minutes of unconsciousness or coma; moderate head injuries as those characterized by 6 hours or less of coma; and, severe head injuries as those resulting in over 6 hours of coma (Jennett & Teasdale, 1981). It should be kept in mind, however, that ratings of severity at the time of trauma are not intended as direct predictions of outcome because prognostic factors other than the early effects of injury influence the recovery process. Therefore, some persons with severe head injuries might achieve good recovery whereas other persons with minor head injuries might make a poor recovery (Jennett, Teasdale, & Braakman, 1979).

Duration of post-traumatic amnesia (PTA) is another method for assessing the severity of head injuries. Significant head injuries are nearly always characterized by a period of retrograde amnesia and a period of anterograde amnesia. Retrograde amnesia describes a loss of memory for events immediately prior to the trauma (hours or days) and sometimes for longer periods of time (weeks or months). Anterograde amnesia, or PTA, implies a state in which the person is awake and alert but does not form on-going memories of his activities. Persons in this state, for example,
can be fully aware of what they are eating during a meal but, shortly afterward, they may not be able to remember having eaten, much less the menu. The following scale based upon the work of Russell and Nathan (1946) and Russell and Smith (1961) classified injuries as very mild, if PTA is less than five minutes; mild, if PTA is between 5 - 60 minutes; moderate, if PTA is 1 - 24 hours; severe, if PTA is 1 - 7 days; very severe, if PTA is 1 - 4 weeks; and, extremely severe, if PTA is more than 4 weeks. Recent investigation confirms that the length of coma and the length of PTA are highly correlated and that both serve as good prognostic indicators (Levin & Eisenberg, 1986).

Still another method of classifying severity of head injuries involves the use of the Glasgow Coma Scale (Teasdale & Jennett, 1974). This scale is based on ratings of patients best response in each of three categories: Eye opening, motor response, and verbal response. Coma scores range from 3 (most severe) to 15 (normal). Patients may be categorized on this scale with scores of 13 - 15 indicating minor injury, scores of 9 - 12 indicating moderate injury, and scores of 3 - 8 indicating severe injury.

Perhaps the most frequently used descriptive scale for head injuries is the Ranchos Los Amigos Scale for Levels of Cognitive Functioning (Hagen, Malkmus, & Durham, 1979) (Appendix E). The process of recovery after a severe head injury can be regarded as a developmental sequence composed of hierarchical stages through which the patient will usually pass as he progresses toward his
maximum level of functioning (Rosenthal, 1983). The Ranchos Scale characterizes each of these stages in behavioral terms allowing medical personnel, researchers and other trained observers to readily estimate levels of cognitive functioning among head-injured patients. These categorical assignments (Stages I - VIII) are not only useful for initial assessment, but are especially helpful as markers in describing the patient’s recovery progress. The gradations are as follows: I. No response, II. Generalized response, III. Localized response, IV. Confused-Agitated, V. Confused-Inappropriate, VI. Confused-Appropriate, VII. Automatic-Appropriate, VIII. Purposeful-Appropriate.

Patients progress through these stages at varying rates. All patients do not experience each phase. In cases of poor recovery, progress may plateau at one of the lower levels.

Other convenient assessment tools to monitor patients progress, particularly prior to and surrounding the clearing of PTA include the Galveston Orientation and Amnesia Test (GOAT) (Levin, O'Donnell, & Grosman, 1979) and the Mini-Mental State (Folstein, Folstein, & McHugh, 1975) (Appendix F). Jackson, Mysiw, and Corrigan (in press) devised a particularly sensitive system for daily monitoring of cognitive functioning in a group situation. Patients Orientation Group Monitoring System (OGMS) scores encompass seven components: Orientation to time, orientation to place, orientation to self and group members, attention span, semantic memory, episodic memory, and use of scheduling aids as compensatory strategies. With this system,
clearing of PTA can be numerically specified, and significant changes in cognitive functioning can be quickly identified. Preliminary investigation suggests that the OGMs may be superior to both the GOAT and the MMS for monitoring of cognitive function and clearance of PTA among head-injured patients (Mysiw, Carpenter, & Corrigan, 1987).

**Minor Head Injury**

The classic study on minor head injury was conducted by Rimel, Giordani, Barth, Boll, and Jane (1981). They evaluated 424 patients 3 months post-injury with the following results: 79% experienced headaches, 59% had memory problems, and 34% of the previously employed patients remained unemployed. Among those patients unable to resume employment, neurological testing was normal but neuropsychological testing revealed deficits in attention, concentration, memory, and judgement in nearly every case. Emotional stress due to the injury was found to be significant but factors regarding compensation and litigation were not. This result refutes the claim that individuals who don't recover well from minor head injuries are malingering for purposes of secondary gain. Gronwall and Wrightson (1974) compared post-concussive patients who recovered well to those who suffered continuing symptoms beyond 35 days post-injury. Using performance on the Paced Auditory Serial Addition Test (PASAT), they demonstrated that speed of information processing was significantly reduced among the group who experienced
post-concussive symptoms such as fatigue, irritability, headache, and difficulty with concentration. In a later study, MacFlynn, Montgomery, Fenton, and Rutherford (1984) found significantly slower reaction times among patients with minor head injuries when compared to a matched sample of general practice control subjects. Alves, Colohan, O'Leary, Rimel, and Jane (1986) report four predominating symptoms among 847 mildly head-injured persons as follows: At discharge, headaches (45.8%), dizziness (14.2%), memory problems (13%), and weakness (10.4%); after one year, headaches (29.2%), dizziness (13%), memory problems (21.3%), and weakness (8.3%). Patterns of symptomatology appear to be both consistent and persistent. Other symptoms associated with post-concussive syndrome include nausea, numbness, diplopia, tinnitus and hearing difficulty (Colohan, Dacey, Alves, Rimel, & Jane, 1986). Ruff, Levin, and Marshall (1986) suggest a schema dividing post-concussive symptoms into three realms: The somatic (headaches, dizziness, blurred or double vision, sleep disturbance, fatigue, and sensitivity to noise and medications); the cognitive (memory deficits, slowed performance, and reduced concentration); and the affective (anxiety, depression, irritability, and mood swings). Because of the wide range of presenting symptoms, they recommend an interdisciplinary team approach for treatment of post-concussive syndrome. One of the most troublesome aspects of minor head injury is that, in the absence of positive neurological signs and physical impairment,
little credibility may be given to persons suffering from this syndrome. Because they seem to be normal, they are expected to meet the demands of daily living. But as Alves et al. (1986) observe: "It is likely that mild but clinically undetectable neurophysical deficits exist and make individuals ability to perform tasks at a pre-injury level unsatisfactory to themselves or unacceptable to others" (Alves, Colohan, O'Leary, Rimel, & Jane, 1986, p. 4).

**Moderate and Severe Head Injury**

Little attention has been directed toward the category of moderate head injury. The effects are generally quite similar to, though less extreme than, those of severe head injury. Consequently, discussion of moderate head injury is frequently subsumed under more general descriptions of serious head injury. In response to this gap in information, Rimel, Giordani, Barth, and Jane (1982) identified 199 patients with moderate head injuries (Glasgow Coma Scale of 9 - 12). At three month follow-up, 93% reported headaches, 90% had memory difficulties, and 87% had problems with activities of daily living. The Halstead-Reitan neuropsychological battery indicated significant deficits across all measures. Sixty-six percent (66%) had not returned to work since injury. Rimel et al. conclude that mortality and morbidity in the moderately injured group is significantly higher than for minor injuries but is not as dramatic as in the severely injured group. They also suggest that persons with moderate head injury
are prime candidates for intensive rehabilitation efforts because, although they have major physical and cognitive deficits, they also have a better chance at achieving rehabilitative success than more severely injured patients.

Severe closed head injury typically results in a plethora of residual disabilities such that "the combination of physical and mental impairments may create a total life disability that is greater than the sum of its parts" (Griffith, 1983, p. 23). Griffith goes on to provide an extensive cataloguing of disabilities related to traumatic head injury. An adapted summary of major points in his listing is presented here.

Disorders of Movement

- spasticity
- rigidity
- ataxia
- apraxia
- hemiparesis-hemiplegia
- quadriparesis-quadriplegia
- dyskinesias

Visual Impairment

- field cuts
- visual perceptual deficits
- diplopia
- cortical blindness
- gaze palsies
Pain Syndromes

shoulder-hand syndromes
heterotopic bone formation
pain related to fractures, peripheral nerve damage, or other injuries
muscle spasms

Communication Disorders

dysarthria
aphasia-receptive/expressive/mixed
apraxia
dyslexia
dysgraphia

Psychological Disabilities

Cognitive-Intellectual
disorientation
memory deficits
decreased new learning
decreased abstraction
sequencing problems
poor judgement
poor initiative
verbal, motor perseveration
confabulation
short attention span
fatigability
Perceptual-Motor Deficits
  reduced motor speed
  reduced eye-hand coordination
  spatial disorientation
  tactile, auditory, visual neglect

Emotional Problems
  impulsivity
  irritability
  aggressiveness
  anxiety
  depression
  emotional lability

Behavior-Personality Problems
  lack of goal directed behavior
  poor self image
  denial of disability
  loss of sensitivity to others
  dependency, passivity

Social Disabilities
  social withdrawal
  lack of acceptance by others
  need for structure
  unemployment/financial difficulties
  loss of leisure skills and interests
  inappropriate social behaviors
  sexual dysfunction
The effects of severe head injury are often devastating. The mortality rate among severely head-injured patients with nonpenetrating injuries is estimated at approximately 48% (Rimel & Jane, 1983). Jennett, Teasdale, and Braakman, studying severe head injury in three countries, (Scotland, Netherlands, and USA) had previously reported similar results for mortality as follows: 48% in Scotland, 50% in the Netherlands, and 50% in the USA. They also cite figures for severe residual disability: 10% in Scotland, 7% in the Netherlands, and 12% in the USA. Lokkeberg and Grunces (1984) found severity of the initial injury to be the best predictor of outcome. Even among patients with so-called "good recovery" as rated by the Glasgow Outcome Scale, residual mental deficits detectable through neuropsychological testing can be demonstrated. Stuss, Ely, Hugenholtz, Richard, LaRochelle, Poirier, and Bell (1983) were able to successfully differentiate control subjects from "recovered" head-injured subjects on selected test measures with 85% accuracy. The crucial variable seemed to be impairment of information processing as observed on tests of divided attention.

Psychosocial Aspects of Closed Head Injury

Perspectives on Etiology

It is widely recognized that closed head injury is associated with numerous, and frequently deleterious, psychosocial consequences. However, the precise etiology of the commonly observed effects remains a subject of both research and debate.
Lezak (1987) offers the opinion that emotional and personality disturbances are more seriously handicapping than residual cognitive and physical disabilities. Reitan and Wolfson (1986) argue against such distinctions, making the point that organic dysfunction typically entails concomitant emotional disturbance.

It generally has been quite difficult to differentiate between intellectual and cognitive losses and their effects on behavior and emotional problems that are not associated with the stresses that accompany neuropsychological deficits. In fact, most persons with cerebral damage probably show some evidence of emotional disorder. (Reitan & Wolfson, 1986, p. 90)

Additional problems arise in attempting to discriminate between the effects of injury and the influence of pre-morbid personality and adjustment status. Jennett, Snoek, Bond, and Brooks (1981) express the caution that previously established patterns of psychosocial maladjustment may be wrongfully attributed to effects of the injury. Likewise, persons with marginal life adjustment prior to the insult, may have difficulty incorporating the increased stress associated with the injury. Their already deficient coping skills may fail, resulting in adverse psychosocial consequences secondary to the injury, but not organically related. van Zomeren and van den Burg (1985) identify two separate clusters of symptoms as follows: Impairments (forgetfulness, slowness, poor concentration, and inability to do two things at once); and intolerances (irritability, fatigue, increased need of sleep, intolerance of light, intolerance of noise, loss of initiative, headache, crying more readily.
intolerance of bustle, more anxious, indifference). The "impairments" were found to be significantly correlated with severity of injury as measured by duration of PTA and time elapsed prior to return to work (RTW). The "intolerances" were not found to be correlated with severity of injury, nor were the total number of complaints related to severity. Zomeren et al. advance the view that the "intolerances" may be neurotic or non-organic in nature as follows:

Neurotic symptoms may result from a chronic effort by the patients to compensate for their cognitive deficits. This effort is an answer to the demands made by the social environment and the patient's own standards. Such demands are made specifically to those patients who are not visibly handicapped and whose injuries are not considered to be so severe as to prevent a complete resumption of previous activities. When the cognitive functions are not yet completely recovered, the resulting stress may lead to intolerances as secondary symptoms, especially in the less severely injured patients. (van Zomeren & van den Burg, 1985, p. 27)

In contrast to the above-mentioned view, Auerbach (1986) proposes a neuroanatomical explanation for similar observations, thereby implying a direct rather than a secondary link to injury. He typifies orbitofrontal lesions as being associated with impulsivity, disinhibition, hyperactivity, and deficits in attention related to an inability to screen out interfering stimuli. These lesions, frequently coup/contrecoup in origin, are characteristic of less severe injuries. He also describes a dorsolateral syndrome characterized by slowness, perseveration, lack of arousal, and inability to attend to stimuli. This syndrome is associated with damage to medial limbic structures or
the mesencephalic reticular activating system. Damage of this type is commonly seen in severe head injuries.

In a similar vein, Stern, Melamed, Silberg, Rahmani, and Groszasser (1985) propose an "extroversion syndrome" and an "introversion syndrome". The "extroversion syndrome" was found to be associated with mild injuries and included the following characteristics: Irritability, low threshold to noise and frustration, acting out, aggressiveness, egocentricity, over demanding behavior, hedonistic tendencies, emotional lability, anxiety, poor attention and concentration, distractibility, and difficulty sustaining tasks over time. The "introversion syndrome" was found to be typical of severe injuries and included these features: Withdrawal from interpersonal relationships, passivity, apathy, dependency on others, lowered self-confidence, dysphoria and depression, slowed mental processes, and little fantasy or imagination. Severity of injury for this study was determined by five parameters: Length of coma, length of PTA, locomotor status, communication ability, and cognitive ability. Stern et al. do not offer a neuroanatomical explanation for these observations as does Auerbach (1986). Instead, they opt for a psychological explanation, suggesting as does van Zomeren (1985), that patients with mild injuries may demonstrate hyperexcitability of the nervous system due to the continuous stress they feel in coping with environmental demands.
present convincing evidence for a direct relationship between neuropsychological deficits and psychiatric symptomatology. Using a dual task paradigm, patients were rated on their ability to attend and respond simultaneously to two equally potent stimuli. Poor performance was found to be significantly associated with low excitability threshold, impulsivity, behavioral perseveration, stereotypic behavior, psychomotor retardation, lack of volition, low frustration tolerance, and a tendency to fatigue easily. Thought processes significantly related to poor performance included dullness of thought, concrete, stereotypic, perseverative thinking, and rigidity of thought. Performance on the task was also compared to the results of a psychiatric interview with each patient and his or her family member. Results indicated that problems with divided attention in the laboratory correlated to life adjustment problems such as inability to maintain or follow a conversation, difficulty in attending to reading materials, and problems with performing complex domestic chores. Perhaps most importantly, level of performance on the dual task successfully differentiated among four functionally distinct groups: (a) persons working in competitive employment, (b) persons working in a sheltered environment, (c) persons not working again but leading active lives, and (d) persons not working and leading a passive existence. This study illustrates the potentially far-reaching
psychosocial effects precipitated by disruption of a basic
cognitive process such as attention.

Levin and Grossman (1978) used scores on the Brief
Psychiatric Rating Scale (BPRS) to determine characteristic
behavioral profiles for head-injured patients at three levels of
severity: Level 1 = transient loss of consciousness or less,
level 2 = comatose for not more than 24 hours, level 3 = coma
exceeding 24 hours. Clear differentiation of the three levels of
injury emerged on four BPRS scales. Cognitive disorganization,
motor retardation, emotional withdrawal and isolation, as well as
affective disturbance were found to increase with the severity of
the injury. Levin and Grossman favor a neuroanatomical
explanation but cannot, as yet, specify the process. As they put
it, "Mechanisms that may be responsible for the behavioral effects
of CHI include altered central neurotransmitter metabolism,
neuroendocrine disturbance related to pituitary involvement,
reduced cerebral blood flow, and disruption of the arousal effects
of the mesencephalic reticular formation" (Levin & Grossman, 1978,
p. 720).

An interesting finding from Keshavan, Channabasavanna, and
Narayana (1981) implicates both organic and psychological
influences affecting psychosocial outcome. Neuropsychiatric
disturbance was found in 80% of the sample. Post-concussion
syndrome accounted for 43% of the disturbance. The predominant
symptoms were described as follows: Headache, giddiness, fatigue,
intolerance to noise, insomnia, anxiety, irritability, poor memory, poor concentration, aggression, euphoria, and apathy. Physical impairment and objective social dysfunction, as measured by the Katz Adjustment Scale, were found to correlate significantly with severity of injury as determined by length of coma, PTA, and intellectual deficits. Total number of subjective complaints, however, did not correlate with severity of injury. Instead, they were found to be more closely related to pre-morbid neuroticism as measured by the PGI Neuroticism Scale (a close relative rated the patient as he or she was prior to injury). The authors suggest anticipatory psychosocial counseling for those patients reporting a history of pre-morbid neurotic tendencies.

Tracing Psychosocial Phenomena

Bond (1976) conducted a classic investigation of psychosocial outcome in severe head injury. He found that social disability was significantly related to neurological, physical, and cognitive dysfunction. He also demonstrated that the duration of PTA was associated with severity of the disability. Social disability was attributed to three major factors: Impaired memory, negative personality traits, and physical dysfunction. Work capacity and leisure activities were the most dramatically affected areas of daily living. He found that families are more tolerant of physical disability than mental disability, especially if memory and/or personality are adversely affected. Bond states that symptoms of mental illness were not significantly related to
physical or social disability. However, he fails to explain how psychiatric illness was assessed which makes this result less interesting. Examination of serial Wechsler Adult Intelligence Scale scores (WAIS) indicated that the most rapid intellectual improvement occurred during the first six months after injury. Verbal skills recovered more quickly than performance skills. PTA of more than 11 weeks seemed to predict poor recovery of intellectual function. Physical, mental, and social outcome were significantly correlated with WAIS results.

Bond's (1976) study served as a starting point for continued research into the psychosocial aspects of closed head injury. Oddy, Humphrey, and Uttley (1978) offered the next major contribution to the field. They assessed 50 severely head-injured persons at 6 months post-injury. Return to work, leisure activities, and social contact were the areas of life most affected. Family relationships, parental behavior, and financial situation were the least affected. Comparative scores for pre-injury functioning were obtained from close relatives via the Katz Adjustment Scale. One-third of the patients had not returned to work after six months. One-third of the patients had not resumed social activities; however, these were not, in all cases, the same persons. Return to work did not guarantee social integration, nor did improved social adjustment always predict an early return to work. An added feature of the Oddy, Humphrey, and Uttley study was the inclusion of a control group (orthopedically injured
persons suffering similar life disruption such as hospitalization and time off work). Comparison with controls revealed that head-injured persons expressed significantly more boredom than control subjects in similar life situations (off work or physically restricted). Boredom remained an issue for the head-injured group even when work and leisure activities were resumed. Another important difference was noted on the dimension of social isolation. Control subjects did not become significantly isolated even in the presence of time off work and physical disability. The most severely head-injured subjects, however, frequently suffered from social isolation. This finding led the authors to propose that the particular features of personality change in head injury (restlessness, irritability, and impatience) may account for the difficulty of social reintegration.

In a later study, Oddy and Humphrey (1980) followed up on these same patients at 12 months and 24 months post-injury. In the area of work, 30 of 45 employed persons had returned to work after 6 months, 7 more returned to work prior to the 12 month mark, while only one more person returned to work between one and two years post-injury. Length of PTA was significantly related to return to work, with shorter PTAs predicting shorter delays in return to work. All but one of the eight patients who did not return to work had PTAs of 7 days or longer. Of those persons returning to work, nine reported a decrease in work abilities. Pre-morbid personality traits of nervousness and suspiciousness
were associated with delays in return to work whereas verbal expansiveness was associated with quicker return. Leisure activities were still notably affected with 50% of the sample reporting a decreased level of activity 12 months post-injury. At 24 months, the situation had not improved which suggests that, in those who remain isolated, the tendency may become firmly ingrained. Again, increasing length of PTA was associated with increased isolation. Motivational deficits may be causative as patients reporting difficulty in becoming interested in things also reported greater isolation. Boredom, defined as subjective distress due to inactivity, was not elevated among those who had fewer social contacts and no work involvement. This result suggests a degree of apathy or inertia among the inactive group. Loss of social contact was not significantly related to adverse personality change in this sample; however, it was significantly related to memory deficits. The authors suggest that memory deficits may render these persons socially inept.

Lezak (1987) followed 39 head-injured persons for three years post-injury. She was able to follow 23 of these persons for an additional two years post-injury. Her primary research instrument was the Portland Adaptability Inventory (PAI) which she developed to include three domains: Temperament and emotionality; activities and social behavior; and physical capabilities. Over the five year period, 40% of the patients continued to report at least ten areas of dysfunction (out of a possible 24). The
highest frequency problems were anger (70%), social contact (90%),
work/school (80%), and leisure activities (85%). The only
patients reporting consistent and rapid improvement were the eight
who had suffered less than 24 hours of coma. Lezak also found
that anxiety, depression, and strain on significant relationship
peaked during the 6 - 12 month post-injury period.

In summation Lezak states,

In all time periods, without exception, the areas most
impaired were social contact, work/school, and leisure, all
having to do with social adjustment. What these
disabilities reflect is a pervasive and almost universal
social dislocation and isolation among head trauma victims.
Furthermore, very high levels of social dislocation and
isolation persist, despite improvement trends for such
emotional and personality disturbances as depression,
impaired initiative, defective social judgment and poor
control over anger. (Lezak, 1987, p. 64)

Both Lezak (1987) and Oddy and Humphrey (1980) cite "loneliness"
as a high frequency subjective complaint among head-injured
patients.

Results of a follow-up on patients seven (7) years post-
injury does not provide encouraging data (Oddy, Coughlan, Tyerman,
& Jenkins, 1985). These patients had originally been studied at
two years post-injury. Perhaps the most dismal observation was in
the vocational realm. All patients who were still unemployed at
the two year mark remained unemployed at the seven year mark. On
a more positive note, all patients employed at the two year mark
continued to be employed at some level, if not on the original
job, at the seven year mark. Leisure activities and socialization
were severely depressed particularly for those patients who had
not returned to work. Loneliness was a major subjective burden with 60% of the sample having no romantic partner. The only patients showing significant progress at the seven year mark were those who had already demonstrated good progress at the two year mark.

**Effects on Families of Head-Injured Patients**

Closed head injury is typically the result of a sudden, traumatic event. It is most frequent among young persons ages 15 - 24 (Anderson, Miller, & Kalsbeek, 1983) who, prior to injury, lead relatively active, independent lives. When severe injury occurs, social roles and the dynamics of the family constellation are dramatically altered. These unanticipated and often difficult changes may result in considerable stress for those closely associated with the head-injured person. Oddy, Humphrey, and Uttley (1978) studied relatives of 54 severely head-injured patients (14 spouses, 30 mothers, and 10 fathers). Relatives were assessed at one month, 6 months, and 12 months post-injury. Instruments used were the Wakefield Depression Scale, the Katz Adjustment Scale, and a symptom questionnaire. Depression in relatives was significantly elevated at the one month period as compared to the 6 and 12 month periods. Level of depression was not significantly related to either severity of the injury or the extent of the patient's recovery of social contact. Two types of personality change in the patient (confusion and verbal expansiveness) were associated with significantly elevated
depression scores for the relative. The total number of complaints on the symptom checklist was also positively correlated with level of depression in relatives. Over 50% of the relatives reported stress due to the head injury at both 6 months and 12 months post-injury. Analysis of relatives' health indicated that 19% suffered from emotional or psychosomatic illness during the first 6 months post-injury and 18% suffered from these conditions at 12 months post-injury. It is important to note that stresses of various kinds on relatives did not diminish with time.

Brooks and McKinlay (1983) report similar findings. In a study of the close relatives of 55 severely injured persons at 3, 6, and 12 months post-injury, objective severity of injury was, again, found to be unrelated to stress. Personality change emerged again as a major determinant of relative's stress or "subjective burden". A time-dependent gradient was observed with relatives reporting comparatively less personality change at 3 months, more at 6 months, and most at 12 months. This result can be alternatively interpreted as a decreased tolerance level in relatives as time stretches on or as a gradual awakening or growing awareness of the problems as relatives work through their denial. The "subjective burden" or strain on relatives was assessed at three levels for this study via an interview questionnaire: High, medium, and low. High-burden relatives nearly always perceived adverse personality change (92%). However, personality change alone was not sufficient to cause a
high-burden rating. Some relatives reporting substantial adverse personality change for the head-injured patient also reported low or medium subjective burden. Perception of burden seems to rest in part on other factors such as the relative's internal resources and personal qualities. Brooks and McKinlay emphasize a need to include family members in rehabilitation counseling, with special attention toward providing information and educational opportunities. They also suggest a direct focus on modifying those behaviors or personality characteristics of head-injured patients most obtrusive to their relatives.

Use of the MMPI in Head Injury Research

Leading neuropsychological researchers warn that the MMPI must be used judiciously with head-injured persons. Reitan and Wolfson (1985) have frequently used the MMPI as a research instrument, but they emphasize that results should not be interpreted uncritically. Instead, profile elevations should be considered in light of existing knowledge about the physical and psychological sequelae of closed head injury. Lezak (1983) offers an example of the integrative approach required when interpreting a head-injured person's MMPI scores:

Thus, for brain damaged patients, acknowledgment of specific symptoms accounts for some of the elevation of specific scales. Pre-morbid personality tendencies and the patient's reactions to his disabilities also contribute to the MMPI profile. The combination of symptom description, the anxiety and distress occasioned by central nervous system defects, and the need for heroic psychological adaptive measures probably account for the frequency with which brain damaged patients produce neurotic profiles. (Lezak, 1983, p. 613)
Results of an early investigation by Reitan (1955) indicated primary elevations on Hypochondriasis (Hs), Depression (D), and Hysteria (Hy) (the "neurotic triad") for the brain damaged group. A later study (Dikeman & Reitan, 1974) confirmed the presence of these elevations, but failed to demonstrate any differential results based on location of injury (laterality and caudality). Perhaps the most fruitful research approach with the MMPI has been a comparative paradigm where absolute scores are less important than relative differences between scores. Studies of this type do not attempt to identify a "personality type" associated with head injury, nor do they emphasize contrasting of results against non-injured groups for diagnostic purposes. Instead these studies center on observing change over time along the dimensions tested by the instrument (within-subjects) or relative differences along the specified dimensions based on differential aspects of head injury such as severity (between-groups).

Dikeman and Reitan (1977) report two basic findings: Initial elevations on Hypochondridiasis (Hy), Depression (D), Hystheria (Hy), Psychasthenia (Pt), and Schizophrenia (Sc) are significantly reduced over time (highest levels immediately post-injury, moderated levels at 12 months, and lower levels at 18 months). They also demonstrated that, regardless of time post-injury, severity of the injury (measured via neuropsychological deficits on the Halstead-Reitan Battery) predicted severity of emotional symptoms. These results are in direct conflict with Fordyce, Roueche, and Prigatano (1983) who find increased
Symptomatology over time as measured by the MMPI. Significantly higher elevations on Depression (D), Psychopathic Deviate (Pd), Psychasthenia (Pt), and Social Introversion (Si) were observed in patients more than 6 months post-injury versus those less than 6 months post-injury. They also looked at severity of injury as a potential variable, using two separate criteria for severity (length of coma; and an impairment index based on Weschler Adult Intelligence Scale (WAIS) performance and portions of the Halstead-Reitan Battery). Severity of injury was not found to be significantly related to levels of emotional disturbance on the MMPI. In addition to the MMPI, these authors also administered the Katz Adjustment Scale. Analysis of the Katz scores paralleled the MMPI findings with no significant effect for severity, an increase in symptomatology over time, and primary elevations on scales for belligerence, withdrawal and retardation, and general psychopathology. Fordyce et al. (1983) postulate a model of affective disturbance among chronic head-injury patients characterized by three components: Anxiety/depression, disorganized or unusual thinking, and social withdrawal. These categories coincide with Levin and Grossman's (1978) summary of findings on the Brief Psychiatric Scale (BPRS) described earlier in this review (cognitive disorganization, motor retardation, emotional withdrawal and isolation, and affective disturbance). It is worth noting that Levin and Grossman (1978), like Dikeman and Reitan (1977), found significant effects for severity of injury based on length of coma.
MMPI findings in research related to other disabilities might be mentioned here to provide some interpretative perspective. Harper (1983) studied adolescents with progressive physical impairment (Duchenne Muscular Dystrophy) and non-progressive physical impairment (mixed orthopedic handicaps). Regardless of the type of disability, significant elevations emerged on Depression (D) and Social withdrawal (Si). Progressive deterioration in the Duchenne group was associated with increasingly higher elevations on Social isolation (Si). Bird, Follett, and Griep (1983) studying patients with myotonic muscular dystrophy were unable to identify typical personality patterns related to the disability. However, they found a significantly higher incidence of emotional disturbance among those patients with lower cognitive levels and greater degrees of physical impairment. These examples from other areas of research are presented here to raise the point that observations on the MMPI for head-injured persons are not necessarily unique to that group and may, indeed, bear considerable relationship to adjustment to disability found among other patient groups.

In an interesting piece of applied research, Heaton, Chelune, and Lehman (1978) divided patients referred for neuropsychological testing into three groups: Those who were employed full-time, those who were employed part-time or at levels below
pre-injury status, and those who were unemployed. A discriminant function derived from both neuropsychological and personality testing successfully identified each functional group with full-time workers obtaining normal range scores, part-time workers obtaining intermediate range scores, and unemployed persons obtaining scores in the pathological range (83.7% correct classification). Neuropsychological ratings alone did not discriminate among groups as well (74.2% correct classification) whereas personality ratings alone determined via the MMPI were not significantly less accurate than the combined index (78.6% correct classification). Increasing elevations on Hypochondriasis (Hs), Depression (D), Psychopathic deviate (Pd), Psychasthenia (Pt), and Schizophrenia (Sc) were associated with reduced employment status. These findings are similar to those previously reviewed in this section with the notable exception of Social introversion (Si) as a discriminating variable. A frequently encountered dilemma is again confronted by Heaton, Chelune, and Lehman (1978): Are the differential personality traits causative in regard to reduced employment status or does reduced employment status and attendant distress cause differential personality traits? These authors suggest that, in reality, an interactive relationship obtains with some traits being accentuated by circumstances, while others may represent pre-existing qualities which influence recovery. In considering this problem, they make an important if obvious point:
Regardless of the etiology of such symptoms, however, if they persist they are likely to interfere with patients' abilities to obtain and perform jobs. (Heaton, Chelune, & Lehman, 1978, p. 415)

This observation returns us to an original premise of this research project as outlined in Chapter I of this document. Establishing pre-morbid versus post-morbid etiology may not be as crucial as describing characteristics of current functioning.
CHAPTER III
METHODS

Research Design

This study is descriptive in nature, utilizing a multivariate approach to investigate the relationship of personality characteristics in patients with closed head injury and their significant others to the post-traumatic adjustment status of the head-injured patients. The design is specifically geared toward implementation in an interdisciplinary setting, incorporating the expertise and clinical judgment of professionals in medicine, neuropsychology, occupational therapy, social work, vocational education, and speech therapy. Instruments used to assess levels of the independent variable (post-traumatic adjustment status of the head-injured person) were as follows:

a. Total score on the Sickness Impact Profile (SIP) via patient's own responses (self-rating)

b. Total score on the Sickness Impact Profile (SIP) via significant other's responses (significant other rating)

c. Total score on the Functional Assessment Inventory (FAI) as determined by composite ratings of an
interdisciplinary team.

The dependent variables in this study, personality characteristics of the head-injured patient (HI) and personality characteristics of his or her most integrally involved significant other (SO), were differentially assessed through the use of the OBD-168 for the HI patients to allow for oral administration and the Minnesota Multiphasic Personality Inventory (MMPI) for the significant others.

Although cognitive functioning was not a focus of direct investigation in this study, its role as a potentially mediating variable was considered. The HI sample population was therefore limited according to two broad-based screening measures designed to estimate or describe cognitive functioning level:

a. Total score on the Mini-Mental State.

b. Level of functioning on the Ranchos Los Amigos Scale as assigned by primary care physician at time of patient's clinic visit.

Upon completion of assessment, six separate sets of data will have been generated as follows:

I. Level of post-traumatic adjustment (Hi vs. Lo)\(^1\), determined by professional ratings, as related to personality characteristics of the head-injured patient.

\(^1\) Low scorers vs. high scorers to be determined by a median split.
II. Level of post-traumatic adjustment (Hi vs. Lo),
determined by patient's self-ratings, as related to
personality characteristics of the head-injured patient.

III. Level of post-traumatic adjustment (Hi vs. Lo),
determined by significant other's ratings, as related to
personality characteristics of the head-injured patient.

IV. Level of post-traumatic adjustment (Hi vs. Lo),
determined by professional ratings, as related to
personality characteristics of the significant other.

V. Level of post-traumatic adjustment (Hi vs. Lo),
determined by patient's self-ratings, as related to
personality characteristics of the significant other.

VI. Level of post-traumatic adjustment (Hi vs. Lo),
determined by significant others ratings, as related to
personality characteristics of that same significant other.

Each of the six data sets were analyzed individually via a
one-way MANOVA technique. Use of MANOVA allows for exploration of
inter-relationships among the ten separate scores which comprise
the dependent measure (i.e., ten MMPI scales or ten OBD-168
dr scales). The design is dichotomous with two levels of a
categorical independent variable and ten dependent variables (a
2 x 10 multifactorial design). Additionally, the three distinct
modes of the independent variable (adjustment level per
professional rating, adjustment level per self-rating, adjustment
level per significant other rating) were compared via a correlational approach to investigate the similarity of perception among these three groups (see Figures 1, 2, and 3).

Subject Description

The sample for this study was composed of 30 head-injured persons ranging in age from 19 years to 56 years with an average age of 28.8 years. Seventy percent (70%) of the sample were under age 30. There were 24 males (80%) and 6 females (20%). Severe head injuries (n = 27) accounted for 90% of the sample, with the remainder (n = 3) being moderate injuries. The average amount of time post-injury was 25.06 months with a range of 6 months to 9 years. A significant other was studied in association with each head-injured subject (n = 30). Among the significant others, 16% were males (4 fathers, 1 husband) and 84% were females (10 wives, 10 mothers, 3 sisters, and 2 grandmothers).

Selection of Subjects

Subjects for this study were consecutive referrals to The Ohio State University Out-Patient Head Injury Clinic who satisfied the predetermined requirements for inclusion. This method of selection was chosen to utilize the clinic personnel for assessment purposes and to guarantee that parameters rated by the primary care physician such as the Ranchos Los Amigos Level of Cognitive Functioning would reflect current status as opposed to a retrospective viewpoint. Purely random selection of subjects from
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* Hi and Lo groups are determined by means of a median split on the distribution of the designated level of adjustment measure (FAI, SIP - self, SIP - significant other).

** Hi and Lo groups refer to level of adjustment in the head-injured person. They are exactly the same groups as those determined for investigation of variables among the head-injured sample.

Figure 1. Multivariate Analysis to Determine the Differential Association of Personality Characteristics with Specified Levels of Post-Traumatic Adjustment (Six One-Way MANOVAs as Outlined Below)
Figure 2. Schematic Diagram Of Research Model
Figure 3. Conceptual Model Of Research Design
the pool of past and present patients of the OSU Out-Patient Head Injury Clinic would be problematic for several reasons:

a. OSU Out-Patient Head Injury Clinic time is primarily devoted to patient care with ongoing research representing an important but secondary objective. Randomly selected persons could not be scheduled for an unnecessary clinic visit simply for the purpose of data collection.

b. While the OBD-168, MMPI, and SIP can be administered outside the clinic setting, the interdisciplinary input on the FAI unique to this study is only possible in the clinic setting where the various professionals specializing in head injury have agreed to incorporate use of the instrument into their standard evaluation procedure.

c. Status of head-injured patients may change over time. Thus, basic ratings made on patients who may not have been seen for a year or more are frequently not valid and could not be used in conjunction with currently gathered information.

Therefore, consecutive referrals or admissions as used in this clinical setting was deemed to be the most practical base for subject selection.
Selection criteria were established as follows:

a. Selection will be limited to those persons with a primary diagnosis of moderate or severe head injury.

b. Selection will be limited to those persons ages 18 to 60, inclusive.

c. Selection will be limited to those persons whose level of cognitive functioning will allow them to comprehend and respond differentially to the test instruments. The mode of response may be written, oral, or through use of a communication system or device. This criterion level will be established by requiring that each subject function at a Level VII or Level VIII on the Ranchos Los Amigos Scale as designated by the primary care physician and that the patient score 27 or above on the Mini-Mental State.

d. Selection will be limited to those persons whose injury occurred no less than 6 months prior to date of testing.

For each HI patient, one significant other (SO) was identified. The major criterion for this designation was the SO's familiarity with patient's current condition based on close proximity, frequent interaction, and patient's self-report. Final selection of a significant other was cleared with one or more of the following persons: Primary care physician, psychologist and/or social worker.
Selection of Instruments

Given the inherent heterogeneity of the head-injured population, selection of research instruments which are both generally applicable and adequately descriptive presents a special challenge. While recovery from head injury most frequently follows a broadly defined, commonly observed sequence associated with characteristic symptomatology, the range of individual variation within that context is wide. Idiosyncratic aspects of recovery and varying patterns of residual deficits can be expected. Final selection of the research instruments represented an attempt to strike the best possible balance between establishing some basic, common denominator parameters versus allowing for myriad individual differences.

Several instruments and methods of measurement have been employed in this study. The OBD-168 was administered to head-injured patients for assessment of personality traits. The Minnesota Multiphasic Personality Inventory (MMPI) was used to assess personality traits of the designated significant others. Level of post-morbid adjustment was measured via the Sickness Impact Profile (SIP) and the Functional Assessment Inventory (FAI). Cognitive functioning was screened through the use of the Mini-Mental State (MMS). Description of each instrument and methods of implementation appear in the respective subsections of this chapter.
The Minnesota Multiphasic Personality Inventory (MMPI)

The Minnesota Multiphasic Personality Inventory (MMPI) was used to assess personality traits of the head-injured patient's identified significant other. The choice to operationalize personality via the MMPI for significant others was made for several reasons. The MMPI is designed to provide an overview of the personality as a whole with resultant profiles reflecting inter-relationships among traits as well as straight-forward measurement of specific qualities as separate entities. Since the research question in this exploratory study is comparatively general in nature, the measurement technique must be broad-based. Current literature on significant others of head-injured patients does not support direct prediction of expected results for specific traits. A priori selection of traits from the overall constellation of potential variables entailed in the concept of personality might increase specificity of measurement but could also cause significant factors to be overlooked. In addition, the MMPI brings with it a legacy of established research providing a backdrop against which results can be viewed with perspective.

Description of the MMPI in this section also pertains to subsequent discussion of the OBD-168 used for personality assessment among the head-injured patients as the OBD-168 is an attenuated, adapted version of the MMPI. The MMPI as developed by Hathaway and McKinley (1943, 1956) is a standardized 566 item, forced choice, true/false questionnaire. It is typically presented as a self-administered, pencil-paper booklet test.
although other less frequently used methods of administration exist such as the card sort and box forms. Scoring of the MMPI results in a profile composed of the relative elevations on each of fourteen scales. There are four validity scales designed to assess various aspects of subject's test-taking orientation. These scales allow for adjustments in calculation and interpretation of the remaining ten clinical scales. The validity scales are as follows:

?  - "cannot say" score
L  - lie scale
F  - infrequency scale
K  - correction scale

The ten clinical scales are the following:

Hs  - Hypochondriasis (1)
D   - Depression (2)
Hy  - Hysteria (3)
Pd  - Psychopathic Deviate (4)
Mf  - Masculinity/Femininity (5)
Pa  - Paranoia (6)
Pt  - Psychasthenia (7)
Sc  - Schizophrenia (8)
Ma  - Hypermania (9)
Si  - Social Introversion (10)

For each scale, a T-score of 50 is the mean with a T-score of 70 or above and 30 or below constituting a discrepancy of two standard deviations from the mean and, by definition, clinically
significant results. Hathaway and McKinley (1967) report test-retest reliability coefficients ranging from .71 to .93 on the thirteen constituent scales. Rosen (1966) reports coefficients of internal consistency ranging from .62 to .88 on the thirteen scales. Validity is supported by the ability to accurately diagnose in 60% of new hospital admissions. High scores on traits, even when not reflected in diagnosis, are almost always evident in the clinical picture (McKinley & Hathaway, 1943).

OBD-168

The OBD-168 (Sbordone & Caldwell, 1979) is a revised version of the 168 question short form of the MMPI developed by Overall and Gomez-Mont (1974). This abbreviated form of the MMPI has been adapted for use among brain-injured persons in the following ways:

a. The total length is reduced to compensate for fatiguability and short attention span among the head-injured.

b. It is designed to allow for oral administration.

c. Questions have been rephrased to avoid potentially confusing syntax. For example, questions containing complex references to time were found to be confusing for many head-injured persons, as were questions involving double negatives.

Apart from the revisions described above, the instrument is essentially composed of the first 168 items of the MMPI. Like the standard MMPI, it is a pencil-paper test presented in a forced choice, true/false format. The primary scales of measurement are
identical to those for the MMPI (validity scales: L, F, K - clinical scales: Hs, D, Hy, Pd, Mf, Pa, Sc, Ma, and Si). The raw scores obtained on the OBD-168 are converted to standard MMPI scores via the regression equations presented by Overall and Gomez-Mont (1974) for conversion of the MMPI-168. Reliability data was reported separately for each scale in comparison to the standard MMPI with a range of .79 to .96. Overall reliability of the OBD-168 was measured at .88. Validity was further demonstrated by high agreement of interscale correlation patterns on both the MMPI and the OBD-168.

Sbordone (1979) acknowledges that the shortened version of the MMPI may result in some loss of information. However, when the potentially distorting effects of fatigue, confusion, and impaired comprehension among head-injured persons are taken into account, tailoring or adapting a standardized instrument to better meet the special needs of this population becomes more defensible. In clinical practice it would be desirable to administer the complete instrument whenever the patient was clearly capable of optimal understanding and responding, reserving the abbreviated version only for those instances in which the full instrument was inappropriate. However, in the research setting, the same instrument must be used for all subjects. In order to provide for a slightly broader range of investigation within the head-injured group, the adapted instrument was selected with a potential cost of less detail and specificity of results.
The Functional Assessment Inventory (FAI)

The Functional Assessment Inventory (FAI) is a 30-item, pencil-paper scale designed for use by a trained counselor or other professional person. The focus of the instrument is to assess potential for vocational adjustment among disabled individuals. However, the authors of the scale (Crewe & Athelstan, 1983) acknowledge that outcome in vocational rehabilitation encompasses a broad range of personal, social, environmental, and functional capacities. Thus, the scale reflects a variety of adaptive living components which prove to be descriptive for head-injured patients.

The FAI is not intended for direct administration to patients. Ratings on the FAI are to be made retrospectively by the counselor/professional based on the results of an immediately preceding examination, direct observation, clinical interview, screening tests, and any other existing knowledge of the patient such as past records. There are four possible response levels to each item reflecting varying degrees of impairment per area according to the following general hierarchy:

0 = no significant impairment
1 = mild impairment
2 = moderate impairment
3 = severe impairment

While this overall key for impairment level holds throughout the instrument, for each individual item, the response levels are more
specifically stated. For example, on item #7 the response choices are as follows:

1. Speech
   
   0. No significant impairment
   
   1. Speech is easily intelligible, but voice quality or speech pattern is distracting; or speech can be easily intelligible with special effort (e.g., taking care to talk slowly).

   2. Speech is difficult to understand. Repetition is often necessary.

   3. Speech is not usable as a means of communication.

It is important to note that the characteristics included in each response level (1 - 3) are intended solely as guidelines and not as criteria for an exact fit. Extensive explanation of the quality to be rated, characteristics associated with certain rating levels, ratings for commonly encountered assessment questions and problems, and illustrative examples are provided for each item in the Functional Assessment Inventory Manual. Additional instructions and clarification for many questions (items 1, 3, 4, 5, 6, 8, 10, 11, 12, 13, 15, 16, 18, 19, 20, 22, 25, 29) appear in a revised set of instructions printed on the front of each Functional Assessment Scale. These were developed to increase rater accuracy based upon user feedback as analyzed by Crewe and Athelstan (1984).

The FAI yields a total score with higher scores indicating greater dysfunction and lower scores indicating better functional capacity. Several factor analytic studies of FAI items across two separate rehabilitation populations (Wisconsin and Minnesota) over
a period of five years have resulted in the identification of
seven basic clusters with only minor differences in factor loading
of individual items. The FAI factors found in the largest sample
(Wisconsin Department of Vocational Rehabilitation N = 1716)
include the following:

Adaptive Behavior
Motor Functioning
Cognition
Physical Condition
Communication
Vocational Qualification
Vision

For purposes of this study, only the total FAI scores were
considered. However, factor scores were computed and profiled for
each patient for potential use in treatment and for future
research efforts focused on developing normative information on
the FAI specific to head-injured patients.

The FAI has been normed on three populations: A sample of
persons served by the Wisconsin Department of Vocational
Rehabilitation (N = 1716), persons served by the Minnesota
Department of Rehabilitation (N = 325), and persons served by the
Minneapolis Society for the Blind (N = 60). Further analysis
conducted by ABT Associates, a research firm based in Cambridge,
Massachusetts, demonstrated that the basic factor structure of the
instrument retained its integrity across various disability
categories such as hearing impaired, orthopedic, mentally ill,
Reliability coefficients for the separate clusters are reported as follows: .868 for Adaptive Behavior, .832 for Motor Functioning, .802 for Cognition, .755 for Physical Condition, .835 for Communication, and .648 for Vocational Qualification. Concurrent validity using expert ratings and physical diagnosis was found to be significant (p > .01) (Crewe & Athelstan, 1981).

Assessment via the FAI was conducted in a manner designed to maximize accuracy and fully utilize the capabilities of the Head Injury Out-Patient Clinic team. The instrument as a whole was broken down to permit the assignment of each question to the professional or professionals most appropriate to the content area. Some questions requiring little technical expertise were assigned an independent rating by all disciplines. By way of example, those FAI questions involving cognitive impairment were primarily assigned to psychology and to medicine as the standard medical exam used in clinic yields some information on the patient's general level of cognitive functioning. Depending on the content area, some of these questions were also assigned to co-raters for the vocational and social work areas when it was judged that their typical interview and screening procedures would contain information pertinent to the question. A complete listing of questions with assigned disciplines appears in Table 1.

Distribution of question assignments was made by the clinic director in consultation with this investigator. To facilitate the process for raters, forms were made for each discipline
<table>
<thead>
<tr>
<th>Question #</th>
<th>Disciplines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Learning abilities</td>
<td>Medicine, Psychology, Occupational Therapy, Vocational Education, (Speech)</td>
</tr>
<tr>
<td>2. Read/write English</td>
<td>Medicine, Psychology, (Speech)</td>
</tr>
<tr>
<td>3. Memory</td>
<td>Medicine, Psychology, (Speech)</td>
</tr>
<tr>
<td>4. Spatial/Form Percepts</td>
<td>Medicine, Psychology, Occupational Therapy (Speech)</td>
</tr>
<tr>
<td>5. Vision</td>
<td>Medicine</td>
</tr>
<tr>
<td>6. Hearing</td>
<td>Medicine, (Speech)</td>
</tr>
<tr>
<td>7. Speech</td>
<td>All disciplines</td>
</tr>
<tr>
<td>8. Language</td>
<td>Medicine, Psychology, (Speech)</td>
</tr>
<tr>
<td>9. Upper extremity functioning</td>
<td>Medicine, Occupational Therapy</td>
</tr>
<tr>
<td>10. Hand functioning</td>
<td>Medicine, Occupational Therapy</td>
</tr>
<tr>
<td>11. Motor Speed</td>
<td>Medicine, Occupational Therapy</td>
</tr>
<tr>
<td>12. Ambulation</td>
<td>Medicine, Occupational Therapy</td>
</tr>
<tr>
<td>13. Capacity for exertion</td>
<td>Medicine</td>
</tr>
<tr>
<td>14. Endurance</td>
<td>Medicine</td>
</tr>
<tr>
<td>15. Loss of time from work</td>
<td>Medicine</td>
</tr>
<tr>
<td>16. Stability of condition</td>
<td>Medicine</td>
</tr>
<tr>
<td>17. Work History</td>
<td>Vocational Education, Social Work</td>
</tr>
<tr>
<td>Question #</td>
<td>Disciplines</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>18. Acceptability to employers</td>
<td>Medicine, Psychology, Vocational Education, Social Work</td>
</tr>
<tr>
<td>19. Personal Appearance</td>
<td>All disciplines</td>
</tr>
<tr>
<td>20. Skills</td>
<td>Vocational Education, Occupational Therapy</td>
</tr>
<tr>
<td>22. Access to Jobs</td>
<td>Vocational Education, Social Work</td>
</tr>
<tr>
<td>23. Special Work Conditions</td>
<td>Medicine, Psychology, Occupational Therapy, Vocational Education</td>
</tr>
<tr>
<td>24. Work Habits</td>
<td>Psychology, Vocational Education</td>
</tr>
<tr>
<td>25. Support System</td>
<td>Social Work</td>
</tr>
<tr>
<td>26. Perception of Capabilities</td>
<td>Medicine, Psychology, Vocational Education</td>
</tr>
<tr>
<td>27. Effective Interaction with Others</td>
<td>Psychology, Vocational Education, Social Work</td>
</tr>
<tr>
<td>28. Judgment</td>
<td>Medicine, Psychology, Occupational Therapy, Social Work</td>
</tr>
<tr>
<td>29. Congruence of Behavior with Rehabilitation Goals</td>
<td>Medicine, Psychology, Occupational Therapy, Vocational Education, Social Work</td>
</tr>
<tr>
<td>30. Initiative and Problem Solving</td>
<td>Medicine, Psychology, Occupational Therapy, (Speech)</td>
</tr>
</tbody>
</table>
listing only those FAI questions for which they were responsible (see Appendix D). Raters completed their FAI scoring immediately after patient's clinic visit. All forms were collected and, using a combined data sheet, the instrument was essentially constituted by computing an average score for each item based on the individually recorded discipline ratings. When this process was completed, each patient had one total FAI score and cluster profile. Using the above-described methodology, the resultant score represents an interdisciplinary assessment reflecting input by experts in several fields. Use of the FAI as an interdisciplinary tool in this setting was designed to increase the accuracy of assessment, improve robustness of the results, and provide a means of cross-validating observations. This multiple rating system allowed for compilation of inter-rater reliability data specific to this study. The average agreement of ratings among disciplines over the thirty questions was calculated via Pearson Product Moment correlations ($r = .708758$).

The Sickness Impact Profile (SIP)

The Sickness Impact Profile (SIP), developed at the Department of Health Services, University of Washington (1977), is a pencil-paper instrument composed of 136 checklist items to be answered in an adapted true/false format (a check mark next to an item indicates "true" while the absence of a mark indicates "false"). The SIP can be utilized via a standardized, interview technique (counselor administration), self-administered with instructions and assistance as needed from the test administrator
within the limits described in the test manual (supported self-administration) or as a completely self-administered instrument sent to subjects through the mail with only a letter of explanation and the printed test instructions (unsupported self-administration). For purposes of this study, the SIP was self-administered within a supervised setting according to the supported self-administered procedure described above.

The SIP was given to the identified significant other (SO) using the same supported self-administration model used with the HI patients. The wording was changed by translating all "I" statements into "he" or "she" statements so that they would clearly be applied to the HI patient. This adaptation was necessary due to the tendency observed among some SO's in field testing to forget the instructed focus and apply the questions directly to themselves.

The SIP was originally developed for the purpose of collecting outcome data on the medical and psychosocial recovery patterns observed among patients with various illnesses or disabilities and across different treatment modalities. It is described as a behaviorally based measure of sickness-related dysfunction. The instrument yields a total, composite score as well as twelve individual category scores as follows:

- **A**  Ambulation
- **M**  Mobility
- **BCM**  Body Care and Movement
- **SI**  Social Interaction
C  Communication
AB  Alertness Behavior
EB  Emotional Behavior
SR  Sleep and Rest
E   Eating
W   Work
HM  Home Management
RP  Recreation and Pastimes

Two major dimensions have also been identified and can be calculated according to the following cluster groups:

Physical Dimension (composed of A – Ambulation, M – Mobility and BCM – Body Care and Movement)

Psychosocial Dimension (SI – Social interaction, C – Communication, AB – Alertness Behavior, EB – Emotional Behavior)

The final version of the Sickness Impact Profile was based on its development and testing within a wide range of patient populations with varying degrees of severity of condition among in-patients, out-patients, chronically ill, elderly, rehabilitation patients, and a general sample of persons not receiving medical care. The instrument was used in a variety of settings and among numerous sub-populations to demonstrate its general applicability. The SIP was found to discriminate successfully among patient groups of known health status. Test-retest reliability of .90 is reported. Establishment of normative data was not a goal of this research as the SIP is primarily designed as an ipsitive measure, providing comparative pre/post
data about a patient prior to and following onset of health-related problems.

In this study, the total SIP score was used as a measure of post-traumatic adjustment. The dimension and category scores were also computed for possible future reference.
As previously outlined, the purpose of this study was (a) to investigate the role of personality variables among head-injured patients in relationship to post-traumatic adjustment and (b) to investigate the role of personality variables among the significant others of head-injured patients as related to the post-traumatic adjustment level of the head-injured patient.

The specific hypotheses tested are restated below with abbreviated identifying labels to assist the reader in following the presentation of results.

Hypotheses
1. Professional ratings - Head-injured Population

**null:** HI-hi = Hi-lo

Will the High-adjusting group of head-injured patients (HI-hi) differ significantly from the low-adjusting group of head-injured patients (HI-lo) on one or more personality variables on the OBD-168 when "level of adjustment" is determined by professional ratings (FAI)?
2. **Self-ratings - Head-injured Population**

null: $HI-hi = HI-lo$

Will the High-adjusting group of head-injured patients ($HI-hi$) differ significantly from the low-adjusting group of head-injured patients ($HI-lo$) on one or more personality variables on the OBD-168 when "level of adjustment" is determined by self-ratings?

3. **Significant Other ratings - Head-injured Population**

null: $HI-hi = HI-lo$

Will the High-adjusting group of head-injured patients ($HI-hi$) differ significantly from the low-adjusting group of head-injured patients ($HI-lo$) on one or more personality variables on the OBD-168 when "level of adjustment" is determined by significant other ratings?

4. **Professional ratings - Significant Other Population**

null: $SO-hi = SO-lo$

When "level of adjustment" is determined by professional ratings (FAI), will the significant others associated with high-adjusting head injured-patients ($SO-hi$) differ significantly from the significant others associated with low-adjusting head-injured patients ($SO-lo$) on one or more personality variables on the MMPI?

5. **Self-Ratings - Significant Other Population**

null: $SO-hi = SO-lo$
When "level of adjustment" is determined by ratings of the head-injured person himself (self-ratings), will the significant others associated with high-adjusting head-injured patients (SO-hi) differ significantly from the significant others associated with low-adjusting head-injured patients (SO-lo) on one or more personality variables?


When "level of adjustment" is determined by ratings of the significant other himself (significant other ratings), will the significant others associated with high-adjusting head-injured persons (SO-hi) differ significantly from the significant others associated with the low-adjusting head-injured patients (SO-lo) on one or more personality variables on the MMPI?

Statistical Analysis

The test statistic selected was Hotelling's T which is a multivariate technique corresponding to a univariate T-test. As the following tables illustrate, no significant main effects were demonstrated (see Tables 2 and 3).

Technically, the absence of main effects for adjustment prevents interpretation of the results on individual dependent variables. The MANOVA technique is considered appropriate for exploratory research (Kennedy, 1977). A number of variables
Table 2
Results Of MANOVA For Head-Injured Group

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Hotelling</th>
<th>F</th>
<th>p&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Professional Ratings</td>
<td>.5041</td>
<td>.96</td>
<td>.5074</td>
</tr>
<tr>
<td>2 Self-Ratings</td>
<td>.8102</td>
<td>1.54</td>
<td>.2007</td>
</tr>
<tr>
<td>3 Significant Other Ratings</td>
<td>.6037</td>
<td>1.15</td>
<td>.3808</td>
</tr>
</tbody>
</table>
Table 3
Results Of MANOVA For Significant Other Group

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Hotelling</th>
<th>F</th>
<th>p&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Professional Ratings</td>
<td>.6848</td>
<td>1.30</td>
<td>.2975</td>
</tr>
<tr>
<td>5 Self-Ratings</td>
<td>.5181</td>
<td>.98</td>
<td>.4881</td>
</tr>
<tr>
<td>6 Significant Other Ratings</td>
<td>.5443</td>
<td>1.03</td>
<td>.4532</td>
</tr>
</tbody>
</table>
thought to be potentially significant may be included and analyzed simultaneously with respect to their relationship to the independent variable. In the case of this study, it appears as though there were numerous dependent variables (i.e., personality traits on the MMPI or OBD-168) which did not, in fact, seem to bear any relationship to the independent variable (adjustment level). It is possible that the overabundance of nonsignificant dependent variables could have served to statistically mask the apparent influence of certain individual dependent variables which, upon inspection of the univariate analyses, appear to differentiate between Hi and Lo adjusters. Results of the univariate analyses are presented here with the caution that they be regarded as adjunctive information only. Empirically based conclusions cannot be drawn from these observations due to failure to achieve statistical significance in the omnibus test. Tables 5 through 10 present univariate results while Tables 12 and 13 provide a summary of univariate findings. Table 4 provides a key for convenient reference and identification of personality traits used in Tables 5 through 10. Table 11 presents head-injured patient and significant other data combined across levels of adjustment. Further descriptive information is depicted via a series of figures. Figures 4 and 5 represent head-injured and significant other data combined over levels of adjustment. Figures 6 through 11 offer graphic representation of univariate results.
Table 4

Key To Personality Traits For The MMPI And The OBD-168

<table>
<thead>
<tr>
<th>Code</th>
<th>Trait</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hs</td>
<td>Hypochondriasis</td>
</tr>
<tr>
<td>D</td>
<td>Depression</td>
</tr>
<tr>
<td>Hy</td>
<td>Hysteria</td>
</tr>
<tr>
<td>Pd</td>
<td>Psychopathic Deviate</td>
</tr>
<tr>
<td>Mf</td>
<td>Masculinity/Femininity</td>
</tr>
<tr>
<td>Pa</td>
<td>Paranoia</td>
</tr>
<tr>
<td>Pt</td>
<td>Psychasthenia</td>
</tr>
<tr>
<td>Sc</td>
<td>Schizophrenia</td>
</tr>
<tr>
<td>Ma</td>
<td>Hypermania</td>
</tr>
<tr>
<td>Si</td>
<td>Social Introversion</td>
</tr>
</tbody>
</table>
Table 5
Head-Injured Patient Personality Traits By Level Of Adjustment: Level Of Adjustment—Professional Ratings (Hypothesis 1)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Hi</th>
<th>Lo</th>
<th>F</th>
<th>p&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ma</td>
<td>Tb</td>
<td>Ma</td>
<td>Tb</td>
</tr>
<tr>
<td>Hs</td>
<td>14.40</td>
<td>58</td>
<td>16.06</td>
<td>59</td>
</tr>
<tr>
<td>D</td>
<td>14.56</td>
<td>46</td>
<td>22.66</td>
<td>65</td>
</tr>
<tr>
<td>Hy</td>
<td>23.66</td>
<td>64</td>
<td>26.00</td>
<td>65</td>
</tr>
<tr>
<td>Pd</td>
<td>25.66</td>
<td>66</td>
<td>26.20</td>
<td>67</td>
</tr>
<tr>
<td>Mf</td>
<td>27.73</td>
<td>65</td>
<td>28.60</td>
<td>67</td>
</tr>
<tr>
<td>Pa</td>
<td>11.86</td>
<td>62</td>
<td>12.00</td>
<td>67</td>
</tr>
<tr>
<td>Pt</td>
<td>27.60</td>
<td>60</td>
<td>27.13</td>
<td>58</td>
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<tr>
<td>Sc</td>
<td>31.20</td>
<td>68</td>
<td>32.53</td>
<td>70</td>
</tr>
<tr>
<td>Ma</td>
<td>23.26</td>
<td>67</td>
<td>22.53</td>
<td>65</td>
</tr>
<tr>
<td>Si</td>
<td>17.06</td>
<td>42</td>
<td>18.06</td>
<td>43</td>
</tr>
</tbody>
</table>

Note. Total n = 30 (15 in Hi group and 15 in Lo group).

Ma = Mean Raw Score on OBD-168.

Tb = Mean T-Score on OBD-168.

No significant results obtained.
Table 6
Head-Injured Patient Personality Traits By Level Of Adjustment: Level Of Adjustment—Self-Ratings (Hypothesis 2)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Hi M⁰</th>
<th>Hi Tb</th>
<th>Lo M⁰</th>
<th>Lo Tb</th>
<th>F</th>
<th>p&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hs</td>
<td>12.80</td>
<td>50</td>
<td>16.40</td>
<td>56</td>
<td>2.73</td>
<td>.1098</td>
</tr>
<tr>
<td>D</td>
<td>18.73</td>
<td>49</td>
<td>24.60</td>
<td>61</td>
<td>2.57</td>
<td>.1199</td>
</tr>
<tr>
<td>Hy</td>
<td>21.80</td>
<td>56</td>
<td>24.20</td>
<td>59</td>
<td>3.30</td>
<td>.0800</td>
</tr>
<tr>
<td>Pd</td>
<td>22.00</td>
<td>57</td>
<td>21.60</td>
<td>57</td>
<td>.73</td>
<td>.4006</td>
</tr>
<tr>
<td>Mf</td>
<td>36.30</td>
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<td>35.80</td>
<td>51</td>
<td>.00</td>
<td>.9730</td>
</tr>
<tr>
<td>Pa</td>
<td>9.93</td>
<td>57</td>
<td>11.13</td>
<td>58</td>
<td>1.25</td>
<td>.2732</td>
</tr>
<tr>
<td>Pt</td>
<td>24.00</td>
<td>48</td>
<td>30.26</td>
<td>57</td>
<td>.91</td>
<td>.3481</td>
</tr>
<tr>
<td>Sc</td>
<td>22.60</td>
<td>50</td>
<td>28.20</td>
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<td>Ma</td>
<td>18.06</td>
<td>53</td>
<td>18.20</td>
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<td>.7884</td>
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<td>Si</td>
<td>24.60</td>
<td>49</td>
<td>28.80</td>
<td>54</td>
<td>5.59</td>
<td>.0253*</td>
</tr>
</tbody>
</table>

Note. Total n = 30 (15 in Hi group and 15 in Lo group).

M⁰ = Mean Raw Score on MMPI.

Tb = Mean T-Score on MMPI.

*Significant at the .05 level or better.
Table 7

Head-Injured Patient Personality Traits By Level Of Adjustment: Level Of Adjustment—Significant Other Ratings (Hypothesis 3)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Hi</th>
<th>Lo</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ma</td>
<td>Tb</td>
<td>Ma</td>
<td>Tb</td>
</tr>
<tr>
<td>Hs</td>
<td>13.86</td>
<td>57</td>
<td>16.60</td>
<td>61</td>
</tr>
<tr>
<td>D</td>
<td>20.40</td>
<td>58</td>
<td>24.60</td>
<td>70</td>
</tr>
<tr>
<td>Hy</td>
<td>23.00</td>
<td>61</td>
<td>26.66</td>
<td>69</td>
</tr>
<tr>
<td>Pd</td>
<td>25.26</td>
<td>63</td>
<td>26.60</td>
<td>67</td>
</tr>
<tr>
<td>Mf</td>
<td>28.13</td>
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<td>60</td>
<td>12.86</td>
<td>64</td>
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<tr>
<td>Pt</td>
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<td>56</td>
<td>28.40</td>
<td>60</td>
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<td>Sc</td>
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</tr>
<tr>
<td>Si</td>
<td>15.46</td>
<td>41</td>
<td>19.66</td>
<td>45</td>
</tr>
</tbody>
</table>

Note. Total n = 30 (15 in Hi group and 15 in Lo group).

Ma = Mean Raw Score on OBD-168.

Tb = Mean T-Score on OBD-168.

*Significant at the .05 level or better.
Table 8

Significant Other Personality Traits - Level of Adjustment Determined By Professional Ratings Of HI Patient (Hypothesis 4)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Hi</th>
<th>Lo</th>
<th>Hi</th>
<th>Lo</th>
<th>F</th>
<th>p&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hs</td>
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<td>51</td>
<td>15.53</td>
<td>56</td>
<td>6.63</td>
<td>.0155*</td>
</tr>
<tr>
<td>D</td>
<td>19.13</td>
<td>49</td>
<td>24.20</td>
<td>58</td>
<td>8.48</td>
<td>.0070*</td>
</tr>
<tr>
<td>Hy</td>
<td>22.33</td>
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<td>23.66</td>
<td>59</td>
<td>1.45</td>
<td>.2382</td>
</tr>
<tr>
<td>Pd</td>
<td>20.90</td>
<td>54</td>
<td>21.40</td>
<td>54</td>
<td>.41</td>
<td>.5266</td>
</tr>
<tr>
<td>Mf</td>
<td>36.90</td>
<td>57</td>
<td>35.26</td>
<td>53</td>
<td>.04</td>
<td>.8513</td>
</tr>
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<td>56</td>
<td>11.26</td>
<td>58</td>
<td>1.03</td>
<td>.3181</td>
</tr>
<tr>
<td>Pt</td>
<td>24.80</td>
<td>50</td>
<td>29.46</td>
<td>58</td>
<td>6.36</td>
<td>.0176*</td>
</tr>
<tr>
<td>Sc</td>
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<td>51</td>
<td>27.86</td>
<td>58</td>
<td>4.49</td>
<td>.0430*</td>
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<tr>
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<td>52</td>
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<td>52</td>
<td>.01</td>
<td>.9179</td>
</tr>
<tr>
<td>Si</td>
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<td>50</td>
<td>32.13</td>
<td>58</td>
<td>6.63</td>
<td>.0156*</td>
</tr>
</tbody>
</table>

Note: Total n = 30 (15 in Hi group and 15 in Lo group).

M<sup>a</sup> = Mean Raw Score on MMPI.

T<sup>b</sup> = Mean T-Score on MMPI.

*Significant at the .05 level or better.
Table 9

Significant Other Personality Traits - Level of Adjustment Determined By Self-Ratings Of HI Patient (Hypothesis 5)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Hi</th>
<th>Lo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ma</td>
<td>14.50</td>
<td>15.90</td>
</tr>
<tr>
<td>Tb</td>
<td>59</td>
<td>62</td>
</tr>
<tr>
<td>Hi L o</td>
<td>Mat * &gt; Marp b F P &gt;</td>
<td></td>
</tr>
<tr>
<td>Hs</td>
<td>14.50</td>
<td>15.90</td>
</tr>
<tr>
<td>D</td>
<td>22.00</td>
<td>23.00</td>
</tr>
<tr>
<td>Hy</td>
<td>24.20</td>
<td>25.46</td>
</tr>
<tr>
<td>Pd</td>
<td>25.66</td>
<td>26.20</td>
</tr>
<tr>
<td>Mf</td>
<td>28.06</td>
<td>28.26</td>
</tr>
<tr>
<td>Pa</td>
<td>11.80</td>
<td>12.06</td>
</tr>
<tr>
<td>Pt</td>
<td>27.06</td>
<td>27.66</td>
</tr>
<tr>
<td>Sc</td>
<td>30.60</td>
<td>33.13</td>
</tr>
<tr>
<td>Ma</td>
<td>23.26</td>
<td>22.53</td>
</tr>
<tr>
<td>Si</td>
<td>15.46</td>
<td>19.66</td>
</tr>
</tbody>
</table>

Note. Total n = 30 (15 in Hi group and 15 in Lo group).

Ma = Mean Raw Score on OBD-168.

Tb = Mean T-Score on OBD-168.

*Significant at the .05 level or better.
Table 10

Significant Other Personality Traits -
Level of Adjustment Determined by Significant
Other Ratings Of HI Patient (Hypothesis 6)

<table>
<thead>
<tr>
<th>Trait</th>
<th>Hi</th>
<th>Lo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Tb</td>
</tr>
<tr>
<td>Hs</td>
<td>13.06</td>
<td>50</td>
</tr>
<tr>
<td>D</td>
<td>18.86</td>
<td>49</td>
</tr>
<tr>
<td>Hy</td>
<td>22.00</td>
<td>56</td>
</tr>
<tr>
<td>Pd</td>
<td>20.40</td>
<td>52</td>
</tr>
<tr>
<td>Mf</td>
<td>36.33</td>
<td>55</td>
</tr>
<tr>
<td>Pa</td>
<td>9.46</td>
<td>56</td>
</tr>
<tr>
<td>Pt</td>
<td>24.46</td>
<td>48</td>
</tr>
<tr>
<td>Sc</td>
<td>22.86</td>
<td>50</td>
</tr>
<tr>
<td>Ma</td>
<td>17.53</td>
<td>52</td>
</tr>
<tr>
<td>Si</td>
<td>24.73</td>
<td>50</td>
</tr>
</tbody>
</table>

Note. Total n = 30 (15 in Hi group and 15 in Lo group).

M<sup>a</sup> = Mean Raw Score on MMPI.

T<sup>b</sup> = Mean T-Score on MMPI.

*Significant at the .05 level or better.
Table 11
Summary of Mean and T-Score Values for Head-Injured Patients and Significant Others: Hi and Lo Adjustment Groups Combined

<table>
<thead>
<tr>
<th>Trait</th>
<th>Head-Injured</th>
<th></th>
<th>Significant Others</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M&lt;sup&gt;a&lt;/sup&gt;</td>
<td>SD</td>
<td>T&lt;sup&gt;b&lt;/sup&gt;</td>
<td>M&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Hs</td>
<td>15.23</td>
<td>4.66</td>
<td>59</td>
<td>14.60</td>
</tr>
<tr>
<td>D</td>
<td>22.50</td>
<td>7.36</td>
<td>65</td>
<td>21.60</td>
</tr>
<tr>
<td>Hy</td>
<td>24.80</td>
<td>5.74</td>
<td>65</td>
<td>23.00</td>
</tr>
<tr>
<td>Pd</td>
<td>25.90</td>
<td>4.25</td>
<td>67</td>
<td>21.16</td>
</tr>
<tr>
<td>Mf</td>
<td>28.10</td>
<td>5.24</td>
<td>66</td>
<td>36.10</td>
</tr>
<tr>
<td>Pa</td>
<td>11.90</td>
<td>4.59</td>
<td>62</td>
<td>10.53</td>
</tr>
<tr>
<td>Pt</td>
<td>27.36</td>
<td>5.92</td>
<td>58</td>
<td>27.13</td>
</tr>
<tr>
<td>Sc</td>
<td>31.86</td>
<td>8.43</td>
<td>69</td>
<td>25.40</td>
</tr>
<tr>
<td>Ma</td>
<td>22.90</td>
<td>3.31</td>
<td>66</td>
<td>18.13</td>
</tr>
<tr>
<td>Si</td>
<td>17.56</td>
<td>5.24</td>
<td>43</td>
<td>28.60</td>
</tr>
</tbody>
</table>

Note. Total n = 60 (30 in Head-Injured group and 30 in Significant Other group).

M<sup>a</sup> = Mean Raw Score on OBD-168.

M<sup>c</sup> = Mean raw score on MMPI.

T<sup>b</sup> = Mean T-Score on OBD-168.

T<sup>d</sup> = Mean T-Score on MMPI.
Table 12
Summary of Results For Patient Personality Traits (OBD-168)

<table>
<thead>
<tr>
<th>Trait</th>
<th>F</th>
<th>p</th>
<th>Mean Hi</th>
<th>Mean Lo</th>
<th>T-Score Hi</th>
<th>T-Score Lo</th>
</tr>
</thead>
<tbody>
<tr>
<td>SI</td>
<td>5.59</td>
<td>.02</td>
<td>15.46</td>
<td>19.66</td>
<td>41</td>
<td>45</td>
</tr>
</tbody>
</table>

Level of Adjustment
Professional Ratings
(no results at p > .05)

Level of Adjustment
Self-Ratings

Level of Adjustment
Significant Other Ratings
Table 13
Summary of Results for Significant Other Personality Traits
(OBD-168)

<table>
<thead>
<tr>
<th>Traits</th>
<th>F</th>
<th>p</th>
<th>Mean Hi</th>
<th>Mean Lo</th>
<th>T-Score Hi</th>
<th>T-Score Lo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hs</td>
<td>6.64</td>
<td>.01</td>
<td>12.8</td>
<td>16.4</td>
<td>50</td>
<td>56</td>
</tr>
<tr>
<td>D</td>
<td>8.48</td>
<td>.007</td>
<td>18.7</td>
<td>24.6</td>
<td>49</td>
<td>61</td>
</tr>
<tr>
<td>Pt</td>
<td>6.36</td>
<td>.01</td>
<td>24.2</td>
<td>30.26</td>
<td>48</td>
<td>57</td>
</tr>
<tr>
<td>Sc</td>
<td>4.49</td>
<td>.04</td>
<td>22.6</td>
<td>28.2</td>
<td>50</td>
<td>58</td>
</tr>
<tr>
<td>Si</td>
<td>6.63</td>
<td>.01</td>
<td>24.6</td>
<td>32.6</td>
<td>49</td>
<td>54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Traits</th>
<th>F</th>
<th>p</th>
<th>Mean Hi</th>
<th>Mean Lo</th>
<th>T-Score Hi</th>
<th>T-Score Lo</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>5.87</td>
<td>.02</td>
<td>20.53</td>
<td>24.2</td>
<td>49</td>
<td>58</td>
</tr>
<tr>
<td>Si</td>
<td>4.92</td>
<td>.03</td>
<td>25.06</td>
<td>32.13</td>
<td>50</td>
<td>58</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Traits</th>
<th>F</th>
<th>p</th>
<th>Mean Hi</th>
<th>Mean Lo</th>
<th>T-Score Hi</th>
<th>T-Score Lo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hs</td>
<td>4.52</td>
<td>.04</td>
<td>13.06</td>
<td>16.13</td>
<td>50</td>
<td>56</td>
</tr>
<tr>
<td>D</td>
<td>7.52</td>
<td>.01</td>
<td>18.86</td>
<td>24.46</td>
<td>49</td>
<td>61</td>
</tr>
<tr>
<td>Pt</td>
<td>4.53</td>
<td>.04</td>
<td>24.46</td>
<td>29.80</td>
<td>48</td>
<td>58</td>
</tr>
<tr>
<td>Si</td>
<td>6.10</td>
<td>.01</td>
<td>24.73</td>
<td>32.46</td>
<td>50</td>
<td>58</td>
</tr>
</tbody>
</table>
Figure 4. Mean T-Score Values of OBD-168 Variables for Head-Injured Patient Group Over All Levels of Adjustment.

Figure 5. Mean T-Score Values of MMPI Variables for Significant Other Group Over All Levels of Adjustment.
Figure 6. Mean T-Score Values of OBD-168 Variables for Head-Injured Patients: Hi vs. Lo Adjustment as Determined by Professional Ratings

Figure 7. Mean T-Score Values of MMPI Variables for Significant Others: Hi vs Lo Adjustment as Determined by Professional Ratings
Figure 8. Mean T-Score Values of OBD-168 Variables for Head-Injured Patients: Hi vs Lo Adjustment as Determined by Self Ratings

Figure 9. Mean T-Score Values of MMPI Variables for Significant Others: Hi vs Lo Adjustment as Determined by Self Ratings
Figure 10. T-Score Values of OBD-168 Variables for Head-Injured Patients: Hi vs Lo Adjustment as Determined by Significant Other Ratings

Figure 11. Mean T-Score Values of MMPI Variables for Significant Others: Hi vs Lo Adjustment as Determined by Significant Other Ratings
Adjunctive Measures

Though outside the scope of the original hypotheses, it was felt that useful additional information could be obtained by looking at the extent of agreement among the three modes of the independent variable.

Pearson product moment correlations (r) were calculated among the three modes of the independent variable (adjustment level per professional rating, adjustment level per self-rating, and adjustment level per significant other rating) to investigate the similarity of perception among these three groups. Results were obtained as presented in Table 14.

These figures represent a significant degree of similarity or agreement among all three measures of adjustment. The perceptions of the head-injured patient and his most significant other were most closely associated. The perceptions of the head-injured patient, himself, and the professionals demonstrated the widest difference.

The strong agreement (p > .0001) reflected across all three measures of adjustment (professionally rated, self rated, significant other rated) reinforces the viability of level of adjustment (Hi vs. Lo) as a discriminating independent variable. Regardless of rating source, the level was similarly identified. Inspection of respective means for Hi vs. Lo groups further support the potency of the median split. For professionally determined adjustment level the mean for the Hi group was 16.2 while the mean for the Lo group was 38.9. For self determined
Table 14
Correlation Matrix For Level Of Adjustment**

<table>
<thead>
<tr>
<th>Level of Adj</th>
<th>Level of Adj Self</th>
<th>Level of Adj Professional</th>
<th>Level of Adj Significant Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Adj Self</td>
<td>x</td>
<td>.66909</td>
<td>.75005</td>
</tr>
<tr>
<td>Level of Adj Professional</td>
<td>.66909</td>
<td>x</td>
<td>.68073</td>
</tr>
<tr>
<td>Level of Adj Significant Other</td>
<td>.75005</td>
<td>.68073</td>
<td>x</td>
</tr>
</tbody>
</table>

** All reported correlations were significant at a .0001 level.
adjustment, the mean for the Hi group was 11.60 while the mean for the Lo group was 31.64. For significant other determined adjustment the mean for the Hi group was 9.33 with the mean for the Lo group at 30.49.
Summary of Findings

This study was designed to explore personality variables associated with post-traumatic adjustment following closed head injury, both in head-injured persons themselves and in their most significant others. Three levels of adjustment were stipulated as follows: Level of adjustment as determined by professionals (measured via the FAI), level of adjustment as determined by the head-injured person (measured via the SIP administered to the head-injured person), and level of adjustment as determined by the significant other (measured via the SIP administered to the significant other). Personality traits were assessed by means of the MMPI for significant others and the OBD-168 for head-injured persons. The six research hypotheses were as follows:

1. Will the High-adjusting group of head-injured patients (HI-hi) differ significantly from the low-adjusting group of head-injured patients (HI-lo) on one or more personality variables when "level of adjustment" is determined by professional ratings?
2. Will the High-adjusting group of head-injured patients (HI-hi) differ significantly from the low-adjusting group of head-injured patients (HI-lo) on one or more personality variables when "level of adjustment" is determined by self-ratings?

3. Will the High-adjusting group of head-injured patients (HI-hi) differ significantly from the low-adjusting group of head-injured patients (HI-lo) on one or more personality variables when "level of adjustment" is determined by significant other ratings?

4. When "level of adjustment" is determined by professional ratings, will the significant others associated with high-adjusting head-injured patients (SO-hi) differ significantly from the significant others associated with low-adjusting head-injured patients (SO-lo) on one or more personality variables?

5. When "level of adjustment" is determined by ratings of the head-injured person himself (self-ratings), will the significant others associated with high-adjusting head-injured patients (SO-hi) differ significantly from the significant others associated with low-adjusting head-injured patients (SO-lo) on one or more personality variables?

6. When "level of adjustment" is determined by ratings of the significant other himself (significant other ratings), will the significant others associated with high-adjusting
head-injured persons (SO-hi) differ significantly from the significant others associated with the low-adjusting head-injured patients (SO-lo) on one or more personality variables?

No main effect for adjustment was observed in any of the six conditions. In no case did statistical analysis warrant rejection of the null hypothesis. With no significant differences emerging on the omnibus multivariate tests, results from the separate ANOVAs subsumed in the overall test statistic (Hotelling $T^2$) are technically uninterpretable. However, it may be of clinical interest to note possible trends suggested by these constituent ANOVAs. Among the head-injured patients, Social Introversion (Si) was elevated when adjustment level was low as self-determined and when adjustment level was low as determined by significant others. Among the significant others, Hypochondriasis (Hy), Depression (D), Psychasthenia (Pt), Schizophrenia (Sc), and Social Introversion (Si) were elevated when adjustment level was low as professionally determined. Depression (D) and Social Introversion (Si) were elevated when level of adjustment was low as determined by the head-injured patient. Hysteria (Hs), Depression (D), Psychasthenia (Pt), and Social Introversion (Si) were elevated when adjustment level was low as determined by the significant other.
Discussion

Methodological Issues

Empirical research focused on head-injured subjects is fraught with methodological problems. Lezak and Gray (1984) enumerate and illustrate some of the most common hurdles. The most generally confounding factor seems to be the inherent heterogeneity of selected head-injured populations, even when certain basic inclusion criteria such as age, severity of damage, and length of time since injury are controlled for in an adequately specific manner. The dilemma, carried to its logical extreme, can be stated as follows: If all the myriad non-experimental between-subject differences were controlled for to maximize sample homogeneity, the "ideal" head-injured subject pool might frequently approach an "n" of one! A delicate balance exists, therefore, in head-injury research between eliminating possible sources of extraneous variance versus assembling samples large enough to perform statistical investigations. At best, even when homogeneity is significantly compromised, head-injury samples tend to be regrettable small. Lezak and Gray (1984) provide a succinct summary of the problem:

Of course, knowing that brain-damaged patients are a highly variable and, for research purposes, unreliable group of subjects, the truly prudent clinical investigator would not begin data analysis until either a statistically suitable number of stable patients had been examined on all variables for as many times as needed, or data had been collected on an enormous amount of subjects. Unfortunately, either goal would take more time to realize than research funding or normal human patience typically allow. Those neuropsychologists whose prudence is limited by patience, money or other practical considerations, and who will want
to do clinical research, must therefore contend with the problems of small and often highly irregular samples. (Lezak & Gray, 1984, p. 108)

This current undertaking, being no exception to the rule, was indeed plagued by the problem of small sample size. Over one full year's worth of consecutive referrals to the OSU Head Injury Clinic were required to glean the relatively small group of 30 subjects who were actually studied. Sample construction was further complicated by the fact that significant others were an integral part of the research design. Although all statistical procedures were based on a sample of 30, the actual number of participants was 60, as each head-injured person had a corresponding significant other. In some cases, an appropriate head-injured person was identified but the significant other(s) refused to participate, thus excluding the potential head-injured participant from the project.

For this study, small sample size creates difficulty in statistical analysis. The MANOVA technique utilized (Hottelings T^2) is conceptually appropriate given the presence of multiple potentially inter-related variables. However, practically speaking, the power of this test is significantly reduced by the small sample size, thus increasing the possibility of making a Type II error (overlooking potentially meaningful findings). In a similar study involving MMPI scores of adolescents with Duchenne Muscular Dystrophy, Harper (1983) chooses to use thirteen separate one-way ANOVAs. He, too, had small sample sizes (29-experimental, 15-control). However, it could be argued that his use of this
method, while more suited to sample size, is inappropriate due to the lack of independence among the MMPI variables. Again, Lezak and Gray (1984) speak clearly to the issue of data analysis in head-injury research:

In this field of endeavor, it is not uncommon for investigators to complete a parametric analysis, and come up with evaluations of the significance of likely-looking differences, that are within the bounds of chance by little more than a hair's breath. Many investigators give up their struggle with the null hypotheses at this point. They report "tendencies", or no differences, or may simply shelve their data and report nothing at all. (Lezak & Gray, 1984, p. 102)

In line with Lezak and Gray's observations on the utility of non-parametric statistics in head-injury populations, the data for this current study were re-examined to explore the possibility that the choice of statistic had obscured potential results. The Sign test (Siegel, 1956) was performed to detect any main effects for level of adjustment which were not uncovered using parametric methods. The Kolmogorov-Smirnov Two Sample test was also performed. Neither of these non-parametric procedures yielded significant results. Again, small sample size may be implicated here as a non-parametric test typically requires an approximately 20% larger sample size than a parametric test to achieve the same alpha level.

Consideration of alternative statistical approaches to the data included reanalysis of the univariate results via the Bonferroni procedure. As the study stands, only one univariate attained significance when alpha was adjusted for repeated comparisons. The Depression (D) scale for significant others with
level of adjustment determined professionally remained potent. It is clear by inspection that if only two or three traits from the MMPI and the OBD-168 had been targeted a priori, calculations via the Bonferroni procedure would yield significant results on those variables. However, post hoc selection of such variables cannot be justified. In addition, if specific traits from the MMPI or OBD-168 were isolated prior to investigation, these measures would no longer be said to embody the concept of "personality" as a whole which was the intended focus of this study. Step-wise regression with adjustment as a continuous variable rather than a nominal variable might also uncover interesting relationships in the data. However, once again, the field of variables must be narrowed to no more than three for a sample of thirty. As a statistical tool for follow-up research in this area, regression analysis may be the method of choice.

If this study is viewed as primarily exploratory in nature, both the statistical approach taken and the interpretative approach to be followed can be justified. The MANOVA in this case yields extremely conservative results with an elevated risk of Type II errors. This approach guards well against making any bold and possibly spurious assertions on the basis of an admittedly small sample. On the other hand, the knowledge that it may be unduly conservative coupled with Lezak and Gray's (1984) general comments on the high probability of Type II errors when using parametric statistics in head-injury research, lends some
confidence to tentative clinical interpretation or speculation based on observed trends in the data.

Before proceeding with a discussion of these trends, it might also be briefly noted that the use of the OBD-168 for the head-injured persons instead of the full version of the MMPI may have contributed to some lack of discrimination of patient personality traits. More trends were observed in the data for the significant others than for the head-injured group. This difference may be, in part, related to the loss of information which occurs when any shortened version of the MMPI is used (Dahlstrom, Welsh, & Dahlstrom, 1972). This potential problem was known prior to implementing the research design. However, the OBD-168 seemed to be a necessary compromise as it allows for oral administration, reduces the issue of fatigue, and features less confusing phraseology.

**Interpretive Comments**

Kennedy (1977) makes the observation that "...mere attainment of a statistically significant result is both highly relative and relatively uninformative ... Unfortunately behavioral researchers frequently have been guilty of paying more reverence to the accomplishment of statistical significance than to the subject matter implications of observed results" (Kennedy, 1977, p. 218-219). Building on these remarks, a case can be made for reviewing the statistically non-significant results obtained in this study. The potential clinical integrity of these findings is supported by
two major observations: (a) the results have face validity, (b) the results are consistent with previous findings in the literature.

With regard to the issue of face validity, it is important to note that the observed changes were all in the "expected" direction. For example, significant others of low-adjusting head-injured patients were found to have elevations on Hypochondriasis (Hy), Depression (D), Psychasthenia (Pt), Schizophrenia (Sc), and Social Introversion (Si) when adjustment level (of the head-injured patient) was determined by professional ratings. Translated into clinical terms, this result suggests that the significant other of a low-adjusting head-injured person is likely to be more preoccupied with somatic concerns, more depressed, more anxious, more prone to psychopathological symptomatology, and more socially withdrawn than significant others of high-adjusting head-injured patients. The clinical picture portrayed here seems at least plausible. By contrast, differences in the "unexpected" direction (e.g., significant others of low-adjusters being less depressed, less nervous than those of high-adjusters) would be counter-intuitive. In that case, the statistical evidence would have to be overwhelming to promote acceptance of an idea which seems illogical or difficult to explain. Face validity or common sense value is certainly not an adequate criterion for judging research results. Yet, it may be worth noting that every observed change in this study occurred in the "expected" direction. The
orderly nature of these changes seems to suggest that something other than random or chance factors are operating.

Support from the literature on psychological aspects of head injury can be summoned to help validate the observed results. In this study, Social Isolation (Si) is the predominant finding among the head-injured patients at two levels of adjustment: Self-ratings and significant other ratings. As described in Chapter II of this document, Social withdrawal and isolation consistently emerged as significant factors in several important studies. Levin and Grossman (1978) cite emotional withdrawal as measured by the Brief Psychiatric Rating Scale (BPRS). Lezak (1987) finds impaired social contact and loneliness using the Portland Adaptability Index (PAI). Fordyce, Roueche, and Prigatano (1983) find the Social Introversion (Si) scale on the MMPI significant ($p < .004$) and the Withdrawal and Retardation Scale on the Katz Adjustment Scale significant ($p < .06$). Stern, Melamed, Silberg, Rahmani, and Groswasser (1985) identify an "Introversion Factor". Oddy and Humphrey (1980) found reduced social contact significant at $p < .005$.

Among significant others, Depression (D) and Social Introversion (Si) were elevated over all three levels of adjustment (professional ratings, self-ratings, and significant other ratings). Hypochondriasis (Hy) and Psychasthenia (Pt) were also elevated over two levels of adjustment: Professional ratings and significant other ratings. Oddy, Humphrey, and Uttley (1978) find similar results for depression using the Wakefield Scale for
Depression. They also identified newly occurring illness in 25% of relatives over the first year post-injury. Illness was classified as follows: Psychosomatic (asthma, migraine, and ulcer) 11%; emotional (defined as those taking prescribed tranquilizers and/or antidepressants) 8%; and physical (all other illness) 8%. Perhaps more importantly, both Oddy, Humphrey, and Uttley (1978) and Brooks and McKinlay (1983) report that stress or "subjective burden" among relatives is not as closely associated with the absolute severity of the injury as with the relative's subjective perception of the effects of injury. These results are in line with the lack of findings in this investigation for an overall adjustment effect. Interestingly, the only effect for adjustment which began to approach some level of significance when the data were reconsidered using a non-parametric approach occurred among personality traits of significant others when level of adjustment of the head-injured person was determined by those significant others (Hypothesis 6).

As outlined above, many of the observations made in this study coincide with similar findings already reported in the literature. While concurrence with established research is desirable, a potential contribution to the field would be more interesting. In terms of new knowledge, this study may offer some clinically if not statistically significant information in regard to the Social Introversion (Si) variable, particularly among significant others. In this current investigation, the Si scale was significantly elevated across all three levels of adjustment.
While social isolation and withdrawal has been reported as a major finding among head-injured patients themselves, the research dealing with family members does not cite social introversion, isolation, and withdrawal as characteristic of the relatives.

This study demonstrates notable differences between the significant others of high-adjusting head-injured patients and significant others of low-adjusting head-injured patients on the Social Introversion (Si) personality variable, no matter how adjustment is determined (professional, self, and significant other). Using a standard interpretation of the Si scale, the results suggest that the significant others of high-adjustment head-injured persons are more out-going, more gregarious, more comfortable in social settings, and more interpersonally interactive as compared to significant others of low-adjusting head-injured persons who might be described as less assertive, more timid, shy, and less socially comfortable and interactive. It is particularly interesting to note that despite the strong relative differences observed on this quality, the trait itself (Si) occurred as a profile high-point only once among the thirty significant other profiles. Interpretatively speaking, it does not appear that extreme social withdrawal or introversion is characteristic of significant others of low-adjusting head-injured patients. Rather, it seems that significant others of high-adjusters versus low-adjusters have differing levels of the trait measured by the Si scale, and that these differences may be associated with adjustment status of the head-injured person in
some way. The nature and direction of that relationship cannot be specified through analysis of the data. On the one hand, it is plausible to view elevated scores on Social Isolation (Si) as an outgrowth of the traumatic situation, especially in those cases where the head-injured person is making a poor adjustment. On the other hand, pre-morbid factors could be operative in that significant others predisposed to assertion, social facility, and interpersonal interaction may provide a different atmosphere for the head-injured person, thus affecting his or her eventual adjustment to some degree.

Perhaps one of the most important clinical inferences which could be made from this study relates to the absolute values of MMPI and OBD-168 T-scores for both the significant others and the head-injured patients. As depicted in Figures 4 and 5 in the Results section of this document, mean values for all scales fall within the normal range. Successive figures (6 - 11) present a similar picture for comparison of Hi vs. Lo adjusters across three measures of adjustment. This observation is clinically significant because it highlights the point that although important differences on key personality traits may exist between Lo and Hi adjusters and their significant others, those differences will probably not present themselves as gross psychopathology. If, indeed, personality differences were consistently in the range of clinical significance, little research would be needed to identify them. However, in the case of more subtle differentiation potentially masked by a cloak of
normality, clinicians may overlook salient personality variables which, if targeted, might respond favorably to intervention. In simplest terms, personality factors may not be directly addressed in treatment unless obvious disturbance is noted. Trends in this study suggest that structured intervention designed to modify a trait such as Social introversion (Si) among significant others could prove to be fruitful even when extreme or abnormal values do not obtain. Further research is needed to validate this speculation.

Future Research Questions

As discussed more thoroughly in the Results section of this document (Chapter IV), inclusion of all scales on the MMPI in a multivariate analysis probably created a great deal of "noise" in the data associated with the many scales which apparently bore no relationship to adjustment. Particularly with a small sample size, the resultant error term could obliterate positive findings (Kennedy, 1977, p. 219). An appropriate next-step to follow up on this initial exploratory research might be to select those variables which appear most interesting and design a study targeted on those qualities alone. If this approach were taken, alternate and multiple means of assessing each conceptual variable should be established rather than using the MMPI as a whole or selecting individual scales from that instrument. While appropriate for initial investigation, the MMPI and its derivative, the OBD-168, prove to be too global for further
refinement and specification of the possible relationships between personality and adjustment.

Approaching the problem from a different angle, applied research paradigms may prove to be more fruitful than further delineation of personality characteristics among head-injured persons and significant others. For example, it could be theorized that if social interactivity is associated with better adjustment, then a treatment intervention designed to increase or facilitate social interaction should improve adjustment. Another question might be as follows: Can the trait measured by the (Si) scale or the MMPI be modified significantly among significant others to provide a potentially more conducive environment for social recovery of the head-injured person, or is the Si trait relatively resistant to change despite intervention? If so, would the identification and inclusion of a lower Si person (i.e., an "advocate" of sorts, such as an uncle, cousin, neighbor who was more gregarious, less withdrawn, and more interactive than the primary care-taker) raise levels of adjustment in the head-injured person? These questions are testable at an empirical level and can be posed without prior resolution of issues regarding the etiology (pre-morbid vs. post-morbid) of the traits under investigation.
Conclusions

Although statistically significant results were not obtained in this study, some potentially interesting trends were observed. To date, relatively little research has been devoted to the role of the significant other in the rehabilitation of head-injured patients. Yet, in nearly all cases of moderate and severe head injury, significant others are intimately involved in the recovery process. This study represents a beginning attempt at teasing out some of the interactive variables which may be subtle but important elements of post-traumatic adjustment.
LIST OF REFERENCES


APPENDIX A

OBD-168 LIST OF ITEMS
PLEASE NOTE:

Copyrighted materials in this document have not been filmed at the request of the author. They are available for consultation, however, in the author's university library.

These consist of pages:

P. 122-129

P. 130-133

P. 135-142

P. 144-166
APPENDIX C

SICKNESS IMPACT PROFILE
LIST OF ITEMS
APPENDIX D

FUNCTIONAL ASSESSMENT INVENTORY
LIST OF ITEMS
RANCHOS SCALE - Levels of Cognitive Functioning

I. No Response - patient appears in deep sleep; coma

II. Generalized Response - inconsistent and nonspecific response to stimuli; earliest response is to deep pain

III. Localized Response - specific response to stimulus, but inconsistent; may follow simple commands in an inconsistent and delayed manner; vague awareness of self

IV. Confused/Agitated - heightened state of activity with severely decreased ability to process information; agitation; wandering; poor discrimination; poor attention span; poor short-term memory

V. Confused/Inappropriate - response to simple command consistently, but with decrease in structure responses are random; confused; increased wandering, agitation as a result of external stimulus, highly distractable, needs frequent re-direction

VI. Confused/Appropriate - goal directed behavior dependent on external direction; shows carry over for tasks he has re-learned; responses may be incorrect due to memory but are appropriate to situation; beginning awareness of his situation; inconsistently oriented

VII. Automat Appropriate - appropriate and oriented; goes through daily routine automatically with shallow recall of activities; lacks insight into condition, poor judgment and problem solving; requires minimal supervision; with structure can initiate tasks and social activities

VIII. Purposeful/Appropriate - able to recall and integrate past and recent events; may show continued decrease to performance relative to premorbid abilities, though functional within society; requires no supervision once new activities are learned
APPENDIX F

MINI-MENTAL STATE
MINI-MENTAL STATE


<table>
<thead>
<tr>
<th>Maximum Score</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ORIENTATION</strong></td>
<td></td>
</tr>
<tr>
<td>5 ( ) What is the (year) (season) (date) (day) (month)?</td>
<td></td>
</tr>
<tr>
<td>5 ( ) Where are we: (state) (county) (town) (hospital) (floor)?</td>
<td></td>
</tr>
<tr>
<td><strong>REGISTRATION</strong></td>
<td></td>
</tr>
<tr>
<td>3 ( ) Name 3 objects: 1 second to say each. Then ask the patient all 3 after you have said them. Give 1 point for each correct answer. Then repeat them until he learns all 3. Count trials and record.</td>
<td></td>
</tr>
<tr>
<td><strong>ATTENTION AND CALCULATION</strong></td>
<td></td>
</tr>
<tr>
<td>5 ( ) Serial 7's. 1 point for each correct. Stop after 5 answers. Alternatively spell &quot;world&quot; backwards.</td>
<td></td>
</tr>
<tr>
<td><strong>RECALL</strong></td>
<td></td>
</tr>
<tr>
<td>3 ( ) Ask for the 3 objects repeated above. Give 1 point for each correct.</td>
<td></td>
</tr>
<tr>
<td><strong>LANGUAGE</strong></td>
<td></td>
</tr>
<tr>
<td>9 ( ) Name a pencil and watch (2 points)</td>
<td></td>
</tr>
<tr>
<td>( ) Repeat the following &quot;No ifs, ands or buts.&quot; (1 point)</td>
<td></td>
</tr>
<tr>
<td>( ) Follow a 3-stage command: &quot;Take a paper in your right hand, fold it in half and put it on the floor&quot; (3 points)</td>
<td></td>
</tr>
<tr>
<td>( ) Read and obey the following: CLOSE YOUR EYES (1 point)</td>
<td></td>
</tr>
<tr>
<td>( ) Write a sentence (1 point)</td>
<td></td>
</tr>
<tr>
<td>( ) Copy design (1 point)</td>
<td></td>
</tr>
</tbody>
</table>

Total Score

ASSESS level of consciousness along a continuum:

<table>
<thead>
<tr>
<th>Alert</th>
<th>Drowsy</th>
<th>Stupor</th>
<th>Coma</th>
</tr>
</thead>
</table>

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