INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI

A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor MI 48106-1346 USA
313/761-4700 800/521-0600

RELATIONSHIP OF AWARENESS OF DEFICITS AND PRE-MORBID COPING SKILLS AMONG REHABILITATION CLIENTS

BY: KAREN A. WISEMAN ©

SUPERVISOR: DR. M. A. MOUNTAIN

SECOND READER: DR. J. TAN

A Thesis

Submitted to the Department of Psychology

in Partial Fulfillment of the Requirements

for the Degree of

Master of Arts

Lakehead University

August, 1996

DESCRIPTIVE NOTE

MASTER OF ARTS (1996) LAKEHEAD UNIVERSITY

Thunder Bay, Ontario

TITLE: Relationship of awareness of deficits and pre-morbid coping skills among rehabilitation clients

AUTHOR: Karen A. Wiseman

SUPERVISOR: Dr. M.A. Mountain

NUMBER OF PAGES: x, 99

ACKNOWLEDGMENTS

I would like to take this opportunity to express my sincerest gratitude to all the individuals who provided me with the assistance necessary for the completion of this thesis.

Specifically, I would like to express my appreciation to:

- Dr. M.A. Mountain
- Dr. J. Tan
- Dr. J.L. Jamieson
- The staff of St. Joseph's General Hospital

I have a tremendous amount of gratitude for all those who helped with this project, and particularly for Dr. M.A. Mountain....I couldn't have done it without your help.

Abstract

One of the most striking deficits following brain injury is an unawareness of injury-related impairments (Anosognosia). It has been proposed that lack of awareness of impaired ability may be classified according to whether it has an organic or psychological origin. The purpose of this study was to investigate the utility of a test instrument, the Patient Competency Rating Survey (PCRS), in determining whether the lack of awareness of deficit exhibited by neurorehabilitation clients is organically based Anosognosia or a manifestation of psychological denial. Consenting consecutive patients (n=49) admitted to the neurorehabilitation unit of St. Joseph's General Hospital in Thunder Bay, Ontario were selected as the target sample for this investigation. Each subject was assigned to a brain injured (BI) or a non-brain injured (non-BI) group. The BI group (n=32) consisted of individuals who had sustained central nervous system damage affecting brain activity, and the non-BI group (n=17) consisted of individuals with neurological damage not directly impacting on brain activity. Each subject's level of awareness of deficits was assessed using the PCRS, and his/her pre-morbid coping techniques were assessed using the Revised Ways of Coping Questionnaire (WOC-R). Comparison of the responses of BI (n=32) and non-BI individuals (n=17) on the PCRS revealed that the relative to the non-brain injured group, the brain injured group overestimated its ability on the following seven critical items: preparing own meals, dressing self, washing dishes, taking care of finances, keeping appointments on time, handling arguments with people well known to the individual, understanding new instructions. Correlations between these critical items and WOC-R coping scales indicated that psychological denial was not responsible for

impaired awareness on four of the critical items. These analyses revealed moderate negative associations between: Positive Reappraisal and preparing meals; Positive Reappraisal and washing dishes; Seeking Social Support and washing dishes; Distancing and handling arguments with people well known to the individual. In addition, a moderate positive association was found between Accepting Responsibility and impaired awareness of deficit in taking care of finances. These results provide evidence that the critical items differentiate between organically and psychologically based impairments of awareness.

TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

TABLE OF APPENDICES

Introduction

Psychosocial Sequelae of Brain Injury

The brain damage that occurs in association with craniocerebral trauma or cerebral vascular accident (CVA) can lead to changes in a wide variety of physical, psychological and social aspects of the affected individual's life. Some of these changes may be temporary, occurring during the acute stage of injury and subsiding with time, while others may be permanent and require substantial long-term adjustment. The psychological sequelae of brain injury are many, and include impaired capacity for self-control or self-regulation, stimulus bound behaviour, increased dependency on others, emotional changes and an inability to learn adequately from social experiences (Bond, 1984). Cognitive dysfunction also frequently accompanies brain damage and is typically clinically observable in the injured person's level of disordered attention, concentration, goal initiation and planning, judgment, perception, speed of information-processing and communication (Prigatano & Fordyce, 1986a). In addition, many brain injured people have been noted to experience profound changes in personality that impact directly on their behaviour, affect and rehabilitation outcome, as well as on aspects of the lives of their family members and friends (Brooks, 1984; Prigatano, 1986).

Research concerning mediators and predictors of quality-of-life following acquired brain injury (ABI) has begun to investigate the impact of injury-related psychosocial sequelae on psychosocial adjustment. In a study comparing the emotional and psychological consequences of brain injury to those associated with spinal cord injury (SCI), Stambrook et al. (1990) discovered that brain injury survivors were considerably more depressed, bewildered, confused, angry and hostile than the epidemiologically similar

SCI group. These findings suggest that over and above having experienced a catastrophic accident with long-term sequelae, ABI survivors must deal with additional burdens associated with brain tissue damage. Other research with brain injury survivors has also indicated that severity of injury is negatively related to favourable psychosocial outcomes during recovery (Moore, Stambrook, Peters, Cardoso, & Kassum, 1990; Stambrook, et al., 1990). This information is of tremendous theoretical importance however, since the members of neurorehabilitation teams (neurosurgeons excluded) are not able to intervene directly to correct the neurophysiological damage that has led to the need for rehabilitation, more research is necessary to identify factors that may promote psychosocial adjustment independently of injury severity. These findings would enable therapists to more effectively optimize post-injury functioning among people with ABI, and to slow or arrest the negative impact of organic damage (Caplan, Callahan, & Haas, 1987).

Recent findings in the field of clinical neuropsychology have provided evidence that various psychological factors are in fact predictive of long-term adjustment following brain injury. According to this research, cognitive mediators may be related to the quality-of-life outcomes of people with ABI. Studies designed to determine the relationship between locus of control (LOC) beliefs and psychosocial outcome among male traumatic brain injury survivors suggest that high internal and low external LOC health beliefs are correlated with improved health-related quality-of-life variables (Moore & Stambrook, 1992; Moore, Stambrook, & Wilson, 1991). In addition, chance external LOC beliefs (i.e.: beliefs that one has little or no opportunity for control over environmental factors) are more strongly related to poor adjustment than are LOC beliefs reflecting some potential for control. These associations between LOC beliefs and quality-of-life appear to operate independently of injury severity, level of education and potential intellectual ability.

Investigation of the post-injury coping styles of people with traumatic brain injury (TBI) has also revealed that optimal psychosocial outcomes are associated with certain coping patterns. Moore and colleagues (Moore & Stambrook, 1992; Moore, Stambrook, & Gill, 1994; Moore, Stambrook, & Peters, 1989) have discovered that in comparison to TBI survivors using other coping patterns to deal with post-injury stressors, male and female survivors who employ an overall low use of coping strategies, but who use the technique of *positive reappraisal*--a strategy in which the individual focuses on positive aspects or outcomes of a stressful situation in an attempt to find meaning in it--as measured by the revised Ways Of Coping questionnaire (WOC-R) experience less emotional and psychosocial difficulty. An association between better psychosocial outcomes (including lower mood disturbances) and the coping strategy of *cognitive buffering*--a technique in which self-deceptions and distortions of reality are used to alleviate distress--was also found among male survivors of TBI (Moore, et al., 1989).

It is readily acknowledged by neuropsychologists that the psychosocial sequelae of brain injury are inadequately addressed using traditional rehabilitation methods. Attempts have been made to resolve this issue by incorporating components of cognitive retraining and psychotherapy into existing neurorehabilitation programmes. Although these modifications have met with some treatment success, their long-term effects have generally been modest (Prigatano & Fordyce, 1986b; Prigatano et al., 1986). Since brain injury is characterized by concrete thinking patterns, it may be possible that augmenting programmes with more specific psychological interventions will enable therapists to more effectively optimize the psychosocial adjustment of persons with brain injury. The aforementioned discoveries regarding the impact of post-injury coping on psychosocial adjustment suggests that coping skills training may be a rewarding intervention strategy.

The limited long-term success of neuropsychological rehabilitation programmes may also be due in part to the altered awareness associated with many cases of cerebral dysfunction. Clinicians frequently report that brain injured clients are unaware of the very deficits that impair their daily performance and levels of psychosocial adjustment (Baars & Banks, 1992; Krantz, 1992). This impairment can influence client motivation for behavioural change and willingness to participate in the rehabilitation process. If individuals do not recognize their own altered higher cerebral functioning, they may continue to engage in socially maladaptive responses despite the rehabilitation efforts of clinicians (Prigatano, 1991). It may be that even the most psychologically oriented neurorehabilitation programme will be largely ineffective if its participants lack insight regarding the nature of their deficits and are not motivated for change. An understanding of the contribution of both biological and psychological processes (such as pre-morbid personality variables and methods of coping with daily stressors) involved in impaired awareness and the translation of this understanding into intervention strategies is essential if neuropsychological rehabilitation is to be effective in the long-term (Baretz & Stephenson, 1976; Forchuk & Westwell, 1987; Naugle, 1988; Rosen, 1986).

Schacter and Prigatano (1991) have proposed that some form of altered awareness has been documented for every major neuropsychological syndrome, and that understanding the nature of this alteration requires examination of several key issues concerned with its organic etiology and potential psychological utility. Their review of clinical literature indicates that a thorough understanding of impaired awareness requires comprehension of the degree, neural basis and specificity of unawareness, as well as whether the brain injured individual has implicit knowledge of unawareness and the likelihood that the unawareness is a form of defensive denial. We will now review the current state of scientific knowledge concerning the biological and psychological bases of impaired awareness following neurological damage.

A Case for Organically Based Post-injury Impaired Awareness

Lack of awareness of deficit due to organic brain injury was first described by Von Monakow (cited in David, Owen, & Förstl) and Anton (cited in Förstl, Owen, & David, 1993), who discovered the phenomenon of impaired awareness associated with cortical deafness and cortical blindness, respectively. It was Babinski (cited in Biaschi, Vallar, Perani, Papagno, & Berti, 1986) who actually introduced the term *Anosognosia* to describe individuals with an unawareness of left hemiplegia following brain injury. The term Anosognosia has since come to refer to any lack of awareness of neurological deficit.

Clinical manifestations of Anosognosia may range from a lack of distress such as often accompanies Capgras Syndrome, to the explicit verbal negation and confabulation frequently associated with hemiplegia and Korsakoff's Syndrome (Alexander, Stuss, & Benson, 1979; Levine, Calviano, & Rinn, 1991). Although Anosognosia has been reported among individuals with Alzheimer's Disease and Schizophrenia, signs of dementia or global changes in consciousness appear unnecessary for its occurrence (Feher, Mahurin, Inbody, Crook, & Pirozzolo, 1991; Myslobodsky, 1986). Empirical observations indicate that some individuals with Anosognosia are capable of a fairly complex level of cognitive processing and that in some cases, those with several deficits may be unaware of one impairment while perfectly aware of others (Biaschi, et al., 1986; Gainotti, Caltagrione, & Miceli, 1977; Young, De Hann, & Newcombe, 1990).

Efforts to determine the underlying neural pathology of Anosognosia have not yielded conclusive findings. The frequency of Anosognosia among brain injured individuals has led researchers to suspect and search for a neuropsychological mechanism as its primary etiologic factor. Heilman (1991) has suggested that Anosognosia is induced by damage to central nervous system monitoring or comparatory systems. This theory is

based on his review of various clinical reports of impaired awareness associated with focal brain lesions such as occur with Wernike's Aphasia, Anton's Syndrome and hemiplegia.

Wernike's Aphasia is a language disorder characterized by confused speech reflecting an inability to comprehend or repeat spoken words. People with the disorder are able to speak fluently, but make frequent phonemic and semantic paraphrasic errors (Smith-Doody, 1993). This pattern of speech occurs most often when lesions have destroyed the posterior portion of the superior temporal gyrus of the left temporal lobe (Benson, 1973)--although the left inferior parietal lobe, including the supramarginal and angular gyri are also often injured.

Wernike's Aphasics with Anosognosia do not attempt to correct their phonemic errors, and may even become angry or disappointed with people who fail to understand them (Alajouanine, 1956). This type of Anosognosia is believed by Heilman (1991), to reflect a defect in the auditory monitor system necessary for the correction of speech errors. Wernike (cited in Heilman, 1991), proposed that the posterior portion of the superior temporal gyrus contains auditory word representations, and that damage to this area of the brain causes these representations to be lost or destroyed. It has therefore been proposed that Wernike's Aphasia-related Anosognosia is due to a dysfunction in the auditory monitor located in the left temporal lobe.

Anton's Syndrome, also known as cortical blindness, is a clinical syndrome in which, although the individual's pupils react to light, he/she is unable to demonstrate functional sight (Hécaen & Albert, 1978). Memory loss, confabulation and visual hallucinations are also typical sequelae of the disorder. Despite visual impairment, people with Anton's Syndrome typically deny experiencing any visual difficulty. The organic pathology associated with Anton's Syndrome includes bilateral cerebral infarcts in the

distribution of the posterior cerebral arteries (usually involving the primary visual and visual association areas of the brain), as well as parietal and temporal lobe injuries. This diversity of organic pathology has made it difficult for researchers to determine the exact mechanism of Anosognosia as it relates to Anton's Syndrome.

Heilman (1991), has suggested that cortical blindness is the result of damage to a hypothetical visual monitor system in the brain. In cases of accurate visual perception, such a monitor receives visual input from the environment and relays that information to other areas of the brain. Destruction or disconnection of the monitor from other brain areas might lead to the confabulation typical of Anton's syndrome. This explanation, although appealing, unfortunately has not been able to help identify the areas of the brain in which such a monitor may be located, or the mechanism by which the monitor is connected to areas involved in speech. An alternative explanation for Anton's Syndrome-related Anosognosia is that a second (subordinate) visual system, mediated by the superior colliculus, pulvinar and temporoparietal regions of the brain, complements the visual system under functional conditions, and continues to function during Anton's Syndrome despite damage to the other visual processing areas. This may provide people with cortical blindness with some visual input, and lead them to perceive and verbally report sight (Weiskrantz, Warrington, Sanders, & Marshall, 1974). It may also be the case that individuals with cortical blindness retain the ability to produce mental visual imagery and that this imagery, in the absence of other visual input may be responsible for the visual hallucinations and Anosognosia that accompany Anton's Syndrome (Heilman, 1991). It is not clear which of these explanations is most appropriate for Anton's Syndrome, and research regarding this disorder continues.

Denial of hemiplegia is most often seen with right hemisphere infarcts (although it has been suggested that detection of Anosognosia in cases of left hemisphere damage is

obscured by frequent concurrent Aphasia), and is associated with lesions to the frontal and parietal regions (Cutting, 1978). Anosognosia with hemiplegia typically takes the form of explicit verbal negation of motor impairment despite neurological evidence to the contrary. As is the case for Anosognosia in Anton's Syndrome, organic etiologic explanations for this type of impaired awareness are numerous. Geschwind (1965a, 1965b) has suggested that lesions of the right hemisphere, resulting in the destruction of a somatosensory monitor and/or its disconnection it from the speech areas of the left hemisphere, are responsible for the disorder. This explanation is compelling, however it does not account for the persistence of anosognosic behaviours when the paralyzed limb is moved into the visual field of the non-affected side of the brain.

False-feedback mechanisms involving a defect in body schema (Head & Holmes, 1911) and inattention or neglect (Biaschi, et al., 1986) have also been offered as causal explanations of denial of hemiplegia, but again, they are unable to account for many clinical variations of the disorder. It may be that a feed-forward (rather that feedback) mechanism, is responsible for Anosognosia. According to the feed-forward hypothesis, an individual's intention system does not set his/her somatosensory monitor; hence when there is no movement feedback, there is no mismatch between sensory input and the monitor, and the individual is unaware of motor failure (Watson, Valenstein, & Heilman, 1981). This explanation is promising in that it offers a plausible explanation for Anosognosia when the paralyzed limb is placed in the attentional field of the individual and he/she is asked to monitor its function.

It has been suggested that whereas damage to more inferior and posterior areas of the brain results in specific manifestations of Anosognosia, frontal lobe damage is associated with a more global lack of awareness. Clinicians report that damage to the frontal lobe or its functions results in a general deficit in self-awareness rather than a focal

disturbance of awareness such as neglect or cortical blindness (Stuss & Benson, 1986). In addition, this more global unawareness may include specific characteristics (i.e.: possible normal function of sensorium, IQ and memory; inappropriate judgment; lack of immediacy and warmth; etc.) that may be used to define its level of severity (Tulving, 1983). Research suggests that because of the differing characteristics of the self, there is a possibility of fractionation of disordered self-awareness, which may be related to specific connections between frontal lobe and other brain regions (Prigatano, 1988; Stuss, 1987).

The qualitative differences of Anosognosia associated with damage to the posterior systems and the frontal lobes of the brain suggest that different neuropsychological mechanisms may be involved in the two types of impaired awareness. Attempts to understand the organic basis of frontal lobe-related Anosognosia have led scientists to propose that a mechanism of reciprocal inhibition, rather than feedback, is responsible for general impairments of awareness (Stuss, 1991). According to this view, both prefrontal and parietal lesions disrupt the frontoparietal reciprocal inhibition system, but the characteristics of resultant Anosognosia differ according to lesion location. In the case of prefrontal damage, Anosognosia appears to take the form of an excessive approach to the environment (resulting in distractibility and concreteness) as well as an excessive distance from intrapsychic processes necessary for insight, foresight and abstraction. This global unawareness is in contrast the specific deficits in awareness typical of lesions in the parietal lobes. Parietal lesions are believed to promote an avoidance of the interpersonal world and an excessive reliance on intrapsychic data, even when this data is in conflict with external reality (Mesulam, 1986).

Current scientific knowledge regarding the organic mechanisms responsible for specific and global Anosognosia provides only a partial explanation of the phenomenon. There remain substantial gaps in our understanding of impaired awareness following brain

injury. Mechanisms of feedback and reciprocal inhibition do not speak directly to the interpersonal variation in awareness that occurs in association with damage to a given region of the brain, nor do they account for unawareness of deficit in cases of neuropathology with no obvious brain tissue damage. It is highly probable that psychological factors play an important role in the extent and nature of post-injury impaired awareness in cases where organic explanations are insufficient.

A Case for Psychologically Based Post-injury Impaired Awareness

The conceptualization of Anosognosia as a motivational and adaptive response to the trauma of brain injury is not new. There is much documentation of psychological denial of illness in cases involving physical or psychiatric disorders. Forms of denial include ignoring warning symptoms of disease, postponing medical evaluation or refusing recommended treatment (Douglas & Druss, 1987; O'Mahoney, 1982). In the case of brain injury, denial of illness is more frequently seen as Anosognosia, and may be interpreted as a psychological refusal to acknowledge loss of cognitive function or physical ability. This is not to say that the organically based hypotheses regarding Anosognosia are without merit, but rather that there exists in the literature evidence that denial of impaired function by brain injured individuals is characterized by *both* organic underpinnings and functional utility in reducing anxiety (Deaton, 1986).

Although most researchers agree that defensive denial similar to that observable among in non-brain injured individuals with chronic illness plays a role in the awareness phenomena exhibited following brain damage, the nature and extent of this contribution is a subject of debate (Schacter & Prigatano, 1991). A portion of this debate is attributable to confusion surrounding the term *denial*. There is little clarity about the essential features of denial, how it should be assessed and under what conditions the terms

"healthy/adaptive" or "pathological/maladaptive" should be applied (Strauss, Spitzer, & Muskin, 1990).

Some researchers use the terms Anosognosia and denial interchangeably, but the two concepts are far from identical. Anosognosia, as defined by Babinski (cited in Biaschi, et al., 1986), is a deficit in awareness on the part of the brain injured individual. This is behaviourally observable as failure to acknowledge a deficit, acknowledgment of a deficit accompanied by the claim that it is due to a force other than disease or illness and active verbal negation of deficit (Kihlstrom & Tobias, 1991; Shaw, Cohen, Doyle, & Palesky, 1985). In contrast, the term denial may characterize either a negative response to a query or a failure to acknowledge an unpleasant aspect of reality (i.e.: deficit). Denial as failure to acknowledge, can be conceptualized as Anosognosia if the individual is truly unaware of reality, but if awareness exists (even if outside the realm of consciousness), it might also reflect deliberate and strategic self-presentation. Redefinition of the term denial is beyond the scope of this paper, but it is important to be cognizant of the impact of definitional issues on the current state of knowledge concerning altered awareness following brain damage. Let us now examine some aspects of the concept of denial.

Freud (1936) first described the defense of denial as occurring when the ego "fends off" some demand from the external world which it feels is distressing. This is a defensive maneuver that involves disavowal of the ego's perceptions from reality and results in the reduction of anxiety. Various theorists have extended the concept of defensive denial to include the disavowal of internal stimuli from consciousness (Miller, 1977). Denial of deficits associated with brain injury might then be viewed as an adaptive reaction, a method of coping with the stress generated by a severe neurological impairment (Labaw, 1969; Sandifer, 1946; Weinstein & Kahn, 1955). It is believed that an individual's pre-morbid experiences, values and habitual modes of structuring his/her social environment

influence the forms of post-injury denial experienced (Weinstein, 1991; Weinstein & Kahn, 1976). Since pre-morbid experience is an important determinant of denial after brain damage, research exploring the relationship of various aspects of this experience to denial-of-illness after brain injury would prove very useful to clinicians working with brain injured people.

Dorpat (1983) has conceptualized denial in a manner that is also readily applicable to the type of impaired awareness of deficits associated with brain damage. According to Dorpat's cognitive arrest theory, an individual's preconscious appraisal of a situation as dangerous (i.e.: the threat of disability/trauma of accident) brings about the formation of painful affect and leads the individual to turns his/her focal attention from the disturbing situation to something less threatening. The painful affect occurs outside the realm of consciousness, but since the rejection of disturbing stimuli requires an arrest of the client's perception or conscious thought about the disturbing situation, gaps in consciousness are created. The individual engages in activities that fill in these gaps, and in the context of brain injury, this may take the form of explicit verbal denial of disability, affective blunting and confabulatory responses. Dorpat's hypothesis receives empirical validation from studies reporting a negative reciprocal relationship between degree of denial and symptoms of depression and anxiety among individuals with chronic illness (Nockleby & Deaton, 1987; Ranseen, Bohaska, & Schmitt, 1990; Reed, Jagust, & Coulter, 1993). It appears that emotional distress is associated with a relatively high level of awareness of disability, whereas individuals engaging in cognitive arrest (preventing them from acknowledging deficits) may believe that they have little reason to be distressed.

Philosophical debate concerning the proper terminology for impaired awareness following brain injury continues, but since we are concerned primarily with the implementation of effective neurorehabilitation programmes, we will turn our attention to

more practical matters. Suffice it to say, that for the purposes of this paper, cases of Anosognosia that are believed to be primarily due to the influence of organic factors (such as a damaged feedback loop that prevents an individual from monitoring his/her behaviour) will be referred to as an 'organically based impaired awareness'. In contrast, when psychological utility is believed to be the primary cause of post-injury impaired awareness (as may be the case with brain damage or with other medical conditions) the terms 'denial' or 'psychologically based impaired awareness' will be used as descriptors.

Treatment of Post-injury Impaired Awareness

Whatever the etiology of Anosognosia, the fact remains that it is a major barrier to long-term psychosocial adjustment following brain injury (Brooks, 1984; Rosen, 1986). Several treatment strategies involving positive (supportive) and negative (confrontive) elements have been suggested as a means of enhancing the anosognosic individual's understanding of present reality when impaired awareness has ceased to serve an adaptive function during recovery. These strategies, which include biofeedback, videotaping social interactions, group therapy and supervised community outings (Deaton, 1986; Youngjohn & Altman, 1989)--may prove more effective at facilitating long-term psychosocial adjustment than have traditional inpatient programmes, since they provide *in vivo* exposure to environmental demands.

As the recovering individual's awareness of deficits approaches objective reality, the amount of psychological distress he/she experiences and the potential for behavioural avoidance is likely to increase. Clinicians must be vigilant for such changes and be prepared to supplement neurorehabilitation programmes with psychotherapeutic interventions. There is evidence that techniques such as relaxation training, and psychoeducation for the brain injured person and his/her relatives may be useful in

reducing the psychological distress that may occur during rehabilitation (Lazarus, 1980; Naugle, 1988). In addition, the previously discussed research concerning coping strategies following brain injury (Moore & Stambrook, 1992; Moore, et al., 1994; Moore, et al., 1989) suggests that enhancing the repertoires of clients' coping skills might be effective in this regard. These anxiety and distress reduction techniques are based on Lazarus' (1976) influential theory of stress and coping. We will now examine the basis of this theory as it relates to psychosocial adjustment following brain injury.

Coping strategies. According to theorists, cognitive appraisal and coping are critical mediators of stressful person-environment relations and their immediate and long-term outcomes (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986). Cognitive appraisal is the process by which an individual evaluates whether an environmental encounter is relevant to his/her state of physical or emotional well-being. Appraisal of an encounter as threatening occurs as a function of the individual's personality characteristics, belief systems, goals and life experiences (Lazarus & Folkman, 1984). If an encounter is appraised as threatening, the individual evaluates the resources and coping methods available to him/her for use in eliminating or minimizing the possibility of situational self-harm. Cognitive appraisal enables the individual to select coping strategies (cognitive and behavioural efforts) to master the internal and external demands of the environmental encounter.

Coping can be conceptualized in terms of two basic strategies: (1) those dealing directly with the problematic situation (problem-focused coping) and (2) those regulating the emotions that arise from a stressful experience (emotion-focused coping) (Folkman,

Lazarus, Dunkel-Schetter, et al., 1986). Investigations with non-brain injured samples have indicated that although individuals typically use both types of coping strategies in any stressful encounter, the specific techniques vary according to the amount of perceived threat posed by the situation and the degree to which outcome is believed to be under the individual's control (Folkman, Lazarus, Gruen, & DeLongis, 1986). Situations perceived as extremely threatening and in which an individual is powerless to exert any influence over outcome for example, will be coped with differently than will less threatening situations or those in which the individual believes his/her cognitive and behavioural efforts are likely to influence the situational outcome. Personal satisfaction with the outcome of encounters, health status, and psychological symptoms have all been shown to vary according to the particular methods of coping used.

In the context of brain injury, cognitive appraisal and coping are complicated by injury-related cognitive changes that include impaired awareness of deficits. One of the key tenets of coping theory is that coping occurs once the individual interprets stressful situational or environmental demands as exceeding his/her personal resources (Lazarus & Folkman, 1984), but it is possible that such an interpretation may not be made by an anosognosic individual. It has been suggested that the characteristic patters of coping exhibited by persons with ABI (Moore & Stambrook, 1994; Moore, et al., 1989) are attributable to organic and/or psychological damage that has limited their access to personal resources available for facing long-term stressors associated with brain injuries. It may be that Anosognosia, while organically based in some instances, may be in others a clinical manifestation of these limitations and serves the purpose of enabling people with brain injuries to avoid psychological distress that might come about as a consequence of acknowledgment of post-injury deficits.

Psychosocial adjustment. Several researchers have found that post-acute brain injured individuals typically exhibit impaired awareness of the extent of their injury-related behavioural and psychosocial problems, and that this impairment is associated with poor psychosocial outcomes (Oddy, 1984; Prigatano & Fordyce, 1986a; Prigatano et al., 1986). In response to this, Prigatano and colleagues have developed an assessment instrument, the Patient Competency Rating Scale (PCRS), to assess the extent to which neurorehabilitation clients display Anosognosia, and have discovered that clients typically rate themselves as more capable at performing certain behavioural and cognitive tasks than do either their family members or rehabilitation workers (Prigatano, Altman, & O'Brien, 1990). The results of studies using the PCRS with brain injured individuals indicate that the greatest deficits in awareness are for those areas assessing emotional control and psychosocial functioning. Since long-term psychosocial adjustment to brain injury is related to post-injury coping patterns and to Anosognosia, it would be worthwhile to clinicians to determine the nature of any interaction among these three variables. Investigating this relationship among brain injured clients will prove problematic however, since the impaired awareness is likely to lead to inaccurate self-reports on coping pattern questionnaires as well as on measures of behavioural and psychological functioning. It is possible that in extreme cases, anosognosics may not even acknowledge the existence of environmental stressors or the need to employ coping strategies. Given these obstacles to research, and the importance of pre-morbid experiences, values, personal interpretations of the meaning of illness (i.e.: cognitive appraisal) and habitual modes of structuring the social environment (and coping with its demands) in post-injury awareness (Weinstein, 1991), an alternative method of investigating the relationship among psychosocial adjustment, coping patterns and Anosognosia, would be to assess whether a brain injured individual's pre-morbid patterns of coping are related to post-injury awareness of deficits and in turn influence his/her psychosocial adjustment. There appears to be no evidence in the existing psychological literature that brain injury alters pre-morbid coping repertoires,

and in fact, neurorehabilitation clinicians typically make use of individuals' pre-morbid coping methods to facilitate post-injury adjustment.

The discovery of a relationship between pre-morbid coping, post-injury awareness and psychosocial adjustment would be of tremendous utility to clinicians as well as theorists. It would not only enhance scientific understanding of the respective roles of psychological and organic factors in Anosognosia, but would enable clinicians to plan treatment programmes that are more effective at facilitating post-injury rehabilitation. A clear understanding of the association between these three variables would facilitate the much needed improvements to current rehabilitation programmes.

The issue of accurate assessment of coping style arises when pre-morbid patterns are the focus of investigation. If Anosognosia is likely to bias responses to questions about post-injury factors, it is also likely to provide a biased assessment of past behaviours. This type of self-report bias may be reduced by having a relative or significant other assess the client's pre-morbid coping skills. Limitations of retrospective questionnaires notwithstanding, enlisting the help of a relative/significant other in this manner would eliminate Anosognosia as a confound in coping pattern assessment, as well as empower the people close to the brain injured person to assist in his/her rehabilitation. Friends and family members of people recovering from brain injuries often report feeling anxious and powerless to help in the recovery of their loved one, and such distress might be alleviated if they were provided with a means of contributing to the therapeutic process.

Rationale of Study

Clinical experience has led us to postulate that individuals with Anosognosia are classifiable according to whether impaired awareness is primarily organic or psychological. Organically based lack of awareness is clinically manifested as impaired self-monitoring capacity, whereas, denial of illness is often a defensive mechanism serving to reduce the psychological distress associated with a full understanding of the impact of brain injury on quality-of-life. Clinicians report that brain injured individuals typically exhibit one of these types of Anosognosia. To date however, this differentiation is made without the use of an objective measure, and is subject to the biases and errors associated with clinical judgment. What is required, is a psychometric measure that may be used to facilitate the clinical judgment that is currently involved in diagnosing and treating Anosognosia.

The purpose of this study was to determine whether a psychometric measure, the Patient Competency Rating Survey (PCRS), is able to differentiate between psychologically and organically based impaired awareness following brain injury. Based on a review of the literature, it was determined that a comparison of post-injury awareness between groups of brain injured and epidemiologically similar non-brain injured individuals would provide valuable insight into whether organic or psychological factors assume a role of primary responsibility in the impaired awareness often found among neurorehabilitation clients. Whereas the impaired awareness exhibited by individuals with brain injury may be due either to organic or psychological factors, that displayed by non-brain injured individuals can only be the result of psychological factors. It was expected that analysis of PCRS responses of the brain injured and non-brain injured groups would reveal between-group differences in awareness for some items. It was further expected that the responses of the brain injured group on these 'critical items' (i.e.: overestimation of underestimation of ability) would indicate an organically based impaired awareness.

If the critical items do in fact reflect organically based Anosognosia, and not denial, correlational analyses with an independent measure of pre-morbid coping should not reflect denial. For the purposes of this study, it was determined that the Revised Ways of Coping Questionnaire (WOC-R) would be used as an independent measure of coping with which to verify the discriminatory utility of the PCRS critical items. The WOC-R is comprised of eight coping scales, each assessing a different method of appraising and dealing with a stressor, and it was hypothesized that critical items of the PCRS would correlate with its coping scales that do not measure denial.

Research has acknowledged that psychology and biology both play roles in the phenomenon of Anosognosia, but to date, no reliable systematic methods of clinical differentiation have been developed. If through continued efforts, researchers discover an objective means of making this sort of differentiation, clinical neuropsychologists will be able to use it in conjunction with their own clinical judgment, to improve rehabilitation programmes. This would facilitate clinicians' selection of resources and techniques most appropriate for promoting psychosocial adjustment following brain injury. If for example, it were possible to accurately diagnose a case of impaired awareness as primarily due to organic destruction of components of the brain's monitoring system, neurorehabilitation workers would know to focus therapeutic efforts on reconstructing the damaged mechanism through confrontation and retraining. In contrast, if a case of Anosognosia were identified as a kind of psychological defense, rehabilitation workers would be alerted to the need to concentrate therapeutic efforts on identifying and eliminating the anxiety responsible for such a defense, rather than directly confronting the brain injured individual with the reality of his/her limitations. The techniques used in treating these two types of impaired awareness are markedly different, and in some cases the incorrect application of a particular intervention may be harmful to the psychosocial well-being of the brain injured individual. As a consequence, it is imperative that clinicians have access to a reliable

means of differentiating organic lack of awareness from psychological denial in cases of Anosognosia.

Method

Subjects

Consecutive patients admitted to the neurorehabilitation unit of St. Joseph's General Hospital in Thunder Bay, Ontario between May 1, 1995 and February 29, 1996 were selected as the target population for this investigation. Of these individuals, those judged by the rehabilitation unit's neuropsychologist as unable to comprehend the nature of the study due to cognitive impairment or language difficulties were excluded as potential subjects. Individuals without these limitations were approached by the neuropsychologist and asked to participate in a study designed to assess the quality of neurorehabilitation provided by the hospital. All willing participants were requested to identify a close significant other or relative who had known them prior to injury and would be willing to participate in the study. Informed consent was obtained from each subject and his/her relative or significant other before proceeding with the investigation. Upon obtaining this consent, each subject and relative/significant other was assured that the information obtained through data collection and analysis would be retained at St. Joseph's General Hospital, and that the results of this study could be obtained by contacting the study's supervising neuropsychologist upon its completion. Please see Appendix A for a copy of the form used in obtaining informed consent.

Demographic information was obtained regarding each subject's date of admission to the St. Joseph's neurorehabilitation unit, date of testing, age, gender, diagnosis, marital

status and relationship to the significant other or friend identified. The sample used in this study consisted of 49 subjects, of whom 65.0% (n=32) had been admitted to St. Joseph's General Hospital after sustaining central nervous system damage affecting brain activity (the brain injured (BI) group), and 35.0% (n=17) admitted as a consequence of neurological damage not directly impacting on brain activity (the non-brain injured (non-BI) group). At the time of testing, two subjects had been discharged from the hospital and given outpatient status. All remaining subjects were tested as inpatients. The diagnoses among the members of the BI group included Cerebral Vascular Accident (n=23), Parkinson's Disease (n=1), Traumatic Brain Injury (n=6) and Multiple Sclerosis (n=2), whereas the non-BI group was composed of individuals with spinal cord injury or quadriplegia (n=6), cervical myelopathy (n=1), polychemia rubra vera peripheral (n=1), transverse myelitis (n=1), hip injury (n=2), chronic pain (n=1) or limb amputation (n=5). The mean time between admission and data collection of data for all subjects was 1.6 months for the PCRS and 2.2 months for the WOC-R.

The brain injured group consisted of 17 men and 15 women ranging in age from 16-84 years old (mean age=56.1, s.d.=20.2). Approximately 59.4% (n=19) of these individuals were married, 6.3% (n=2) were divorced, 15.6 % (n=5) were widowed and 18.7% (n=6) were single. In all but five cases in which the brain injured subjects were married, the spouse was used to complete the significant other/relative portion of the study (n=14). The remainder of the subjects identified first degree relatives or the spouses of first degree relatives (n=14), third degree relatives (n=1), romantic partners (n=1) or close friends (n=2) as the person to be contacted for completion of the WOC-R.

The control group consisted of six men and eleven women ranging in age from 27-78 years old (mean age=52.2, s.d.=16.8). Approximately 47.1% (n=8) of these individuals were married, 17.6% (n=3) were widowed and 35.3% (n=6) were single. No members of

the non-BI group were divorced. In only three of cases in which the non-brain injured subjects were married, the spouse was used to complete the significant other/relative portion of the study. The remainder of the subjects identified first degree relatives (n=12), second degree relatives (n=1) or close friends (n=1) as the person to be contacted for completion of the WOC-R.

Test Materials

Patient Competency Rating Survey (PCRS). This instrument, developed by Prigatano and colleagues (1986) is a 30-item scale that requires the brain injured respondent to judge his/her perceived degree of current competency in a wide variety of daily tasks. Each item of the survey is rated independently by the brain injured person and a third party (such as a relative or a trained staff member in the rehabilitation setting). Ratings are based on a five-point Likert scale where a rating of one indicates that the individual cannot perform the task described, and a rating of five indicates that the task can be performed with ease. The level of awareness of deficit in performance of a particular task is assessed by subtracting the third party's rating from the brain injured person's rating for that particular item. This calculation provides a difference score for each item (D_i). A positive difference score indicates that the subject has overestimated his/her level of competency on that item, whereas a negative D_i score indicates an underestimation of ability on the subject's part.

Prior to analyzing the data, each item of the PCRS was classified according to whether it reflected a concrete or abstract area of functioning. Items pertaining to physical activity or overt behaviour were identified as concrete, whereas those assessing interpersonal interactions, emotional control and cognitive capacity were identified as abstract. The PCRS items were grouped in this manner, based on the supposition that

items assessing concrete and abstract activities might be associated with different kinds of post-injury awareness.

Research using the PCRS to assess post-injury awareness among persons with traumatic brain injury has indicated that brain injured individuals typically overestimate their ability to perform on 10 of the 30 items, but demonstrate good agreement with the third party rater on some of the other items (Prigatano, et al., 1990). These results have been found using both a relative of the brain injured person and hospital staff members as the third party, although the ratings given by relatives are typically closer in agreement to the injured person's self-ratings than are those of the staff members (Prigatano et al., 1986), a finding that suggests relatives may be more lenient when rating subjects than are staff members. There appears to be no published reliability of validity data concerning the PCRS, however a study (Prigatano, 1996) replicating previous research regarding the PCRS points to construct validation of the concept that impaired awareness after brain injury is measurable with the instrument. In addition, the PCRS items themselves, have face validity since they refer to daily aspects of living for which awareness of deficit is necessary. For the purposes of this study, the third party rating using the PCRS was obtained from the occupational therapist at St. Joseph's General Hospital most closely involved in the treatment of each subject. Please see Appendices B and C respectively for subject and third party versions of the PCRS.

Revised Ways of Coping questionnaire (WOC-R). The WOC-R questionnaire consists of 66 items that describe a broad range of cognitive and behavioural strategies used to manage the demands associated with stressful encounters of daily living (Folkman & Lazarus, 1988). The questionnaire requires the respondent to recall a stressful incident he/she has experienced and indicate the methods used to cope with it by rating each item according to a four-point Likert scale. A score of zero on an item indicates that the

coping strategy it describes does not apply or was not used in that situation, whereas a score of 3 indicates that the strategy was used a great deal.

The WOC-R items belong to eight empirically derived scales (Confrontive Coping, Distancing, Self-Controlling, Seeking Social Support, Accepting Responsibility, Escape-Avoidance, Planful Problem Solving, Positive Reappraisal) for which raw or relative scores may be calculated. Raw scores are the sum of the individual's responses to the items comprising a given scale and provide a summary of the extent to which each type of coping used in the stressful encounter. Relative scores in contrast, provide a description of the contribution of each coping scale relative to all of the scales combined. For the purposes of statistical analyses, raw scores were used. Please see Appendix D for a copy of the WOC-R and a description of the coping scales.

The WOC-R's measurement of coping processes, necessitates use internal consistency rather than traditional test-retest measures of its reliability as a psychometric instrument. Internal consistency measures for the eight WOC-R coping scales are higher than those typically reported for most other measures of coping. (Note: Internal consistency estimates of coping measures generally fall at the low end of the traditionally acceptable range). According to the test manual (Folkman & Lazarus, 1988), the alpha values of the WOC-R scales are: 0.79 for Positive Reappraisal, 0.76 for Seeking Social Support, 0.72 for Escape-Avoidance, 0.70 for Confrontive Coping and Self-Controlling, 0.68 for Planful Problem Solving, 0.66 for Accepting Responsibility and 0.61 for Distancing. The stability of WOC-R factor structure has been assessed across populations and stressful episodes, and has revealed convergence with respect to several but not all of the interment's factors. It is unclear whether variance in factor structure is a function of the people, situations, administrative procedures or psychometric properties of the instrument (Folkman and Lazarus, 1988). Unfortunately, there is no data available

concerning the factors associated with pre-morbid coping among individuals with brain injury or neurological damage.

The items of the WOC-R have face validity since they reflect strategies reported by individuals coping with stressful demands. Construct validity is suggested by the fact that the results of coping strategy research is consistent with the theoretical predictions that coping is a process involving the use of problem-focused and emotion-focused strategies. The coping strategies assessed by the WOC-R differ in the extent to which they are variable or stable across situations, however this too is a tenet of coping theory (Please see Folkman & Lazarus, 1988 for a more detailed account of this validity research).

The WOC-R has been used primarily as a research instrument in the study of the coping process and the determinants of this process in a variety of stressful conditions, including traumatic brain injury (Moore & Stambrook, 1994). The WOC-R is a process-oriented, rather than trait-approach measure of an individual's cognitive and behavioural attempts to deal with stressful encounters. At first glance, one might question the appropriateness of using a process-oriented measure to assess pre-morbid coping styles, since the assumption that pre-morbid coping repertoires are maintained after brain injury implies that coping style is a trait characteristic. Unfortunately, traditional trait measures of coping have shown only modest predictive value of future coping measures, and have tended to underestimate the complexity and variability of the coping process (Folkman & Lazarus, 1988). Our decision to use the revised Ways of Coping Questionnaire as an independent measure of coping was based on the notion that since trait measures are not predictive of behaviour during specific stressful encounters, a process-oriented measure would be an appropriate alternative. In addition, the WOC-R's multidimensional measurement of coping includes a wide range of coping strategies (including denial) and its ability to assess dynamic person-environment interactions (also crucial to psychosocial

adjustment following brain injury) during stressful encounters were assets instrumental in its selection as our independent measure of coping.

Procedure

Pilot study. Prior to commencing data collection, inter-rater reliability of rehabilitation staff workers--for PCRS items--was assessed. Three occupational therapists (raters) working with the neurorehabilitation clients of St. Joseph's General Hospital independently assessed four randomly chosen test clients, using the PCRS. An item-by-item analysis of these ratings was conducted for each test client, as well as for pooled data obtained from all test client evaluations to determine inter-rater reliability. Once it was determined that inter-rater correlations were above $r=0.70$ at a significance level of $\alpha=0.05$ for two of the three pooled test client correlations, the raters were requested to employ the method of rating used in the pilot study while collecting data for the main study.

Main study. After providing the researcher with informed consent, each subject was requested to complete the PCRS. Subjects were read the instructions on the questionnaire, and were encouraged to answer each item as honestly and as accurately as possible. The occupational therapist most closely affiliated with the subject was requested to complete a third party version of the PCRS at approximately the same point in the rehabilitation process. All PCRS questionnaires were scored by a Lakehead University Master of Arts student, and the relevant calculations were transferred to a data sheet identifying subjects by number only. Data sheets were used to record subjects' self-ratings and third party ratings for each PCRS item. Difference scores were calculated by subtracting third party ratings from self-ratings for each item, and were recorded on the data sheets. The data sheet and both versions of the PCRS were stored securely in a filing

cabinet in the acquired brain injury office of St. Joseph's General Hospital. Please see Appendix E for copies of the data sheets.

The relative or significant other (respondent) identified by each subject was contacted by the Lakehead University Master of Arts student, and asked to complete a WOC-R. After giving informed consent, the respondent was instructed to respond to the questionnaire items according to how his/her relative or significant other (i.e.: the subject) dealt with a specific stressful encounter. Responses were limited to stressful encounters that occurred prior to brain injury or other damage responsible for hospitalization. Since the WOC-R is typically administered as a self-report questionnaire, the Master of Arts student used it as a structured interview to avoid any confusion that might result from this change in administrative procedure. As was the case for the PCRS questionnaires, the WOC-Rs were scored by a Lakehead University Master of Arts student, and the relevant calculations were transferred to a data sheet identifying each subject by a number only. Data sheets were used to record the responses of each subject's significant other/relative to the WOC-R. Raw and relative scale scores were calculated using this information and were also recorded on the data sheets. The data sheet and WOC-R for each subject were stored securely in a filing cabinet in the acquired brain injury office of St. Joseph's General Hospital. Please see Appendix E for copies of the data sheets.

Results

Pilot Study

Analyses were conducted to assess the variability between rating systems of the three hospital raters involved in data collection. Bivariate correlational analyses revealed greater inter-rater consistency for all test clients combined than for individual test clients. Correlations between raters, for pooled test clients, ranged from 0.67 to 0.80 (mean

$\underline{r}$=0.75) and were all positive and statistically significant. Correlations between raters for each test client ranged from 0.02 to 0.73 (mean $\underline{r}$=0.56). Comparison of the ratings of test client #1 by rater #1 (OT1) and rater #3 (OT3) resulted in a very low, non-significant correlation coefficient, however all remaining correlations between therapists were statistically significant. Please see Table 1 for a summary of these inter-rater reliability coefficients.

The results of the pilot study suggested that the systems used by the raters were consistent and reliable. The findings indicated that these rating systems were suitable for use during data collection in the main study. Overall, consistency was demonstrated between raters, although some discrepancies occurred for individual assessments of test clients with whom some raters had experienced little or no previous contact. In the case of all four test clients, weakest inter-rater correlations were found when one rater was well acquainted, and the second, unfamiliar with the test client at the time of assessment. Observational skills, experience and clinical judgment may have enabled the raters less familiar with a particular test client to conduct valid assessments of measurable behaviours and verifiable cognitions, however some of the more psychologically oriented areas of functioning (i.e.: abstract items on the PCRS) may have required the rater to draw upon previous experiences with the test client, thus reducing the accuracy of assessments in cases for which little previous client-therapist contact had occurred. In order to guard against rater errors due to lack of familiarity with subjects in the main study, it was determined that the ratings obtained during the main study would be made only by the rater most familiar with each subject.

Main Study

Patient Competency Rating Survey (PCRS). Difference scores (D_i) were calculated for each PCRS item by subtracting the competency score given by the occupational therapist from that given by the subject. Group mean D_i scores indicate that subjects in the brain injured group (n=32) overestimated their level of competency on 62.5% of the items assessing concrete areas of functioning. Agreement with therapist competency ratings occurred for 12.5% of the concrete items, whereas the remaining 25.0% were characterized by underestimation of ability on the part of the subjects. In contrast, the responses of the non-brain injured group (n=17) to PCRS concrete items were characterized by frequent underestimation of ability (87.5% of the items), no agreement with therapist ratings, and little overestimation of competency (12.5% of the items). Please see Table 2 for a summary of mean D_i scores obtained for the PCRS concrete items.

Group mean difference (D_i) scores also indicate that the subjects in the brain injured (BI) group overestimated their level of competency on 42.9% of the items assessing abstract areas of functioning. The remaining 57.1% of these items were characterized by underestimation of ability on the part of the subjects. The responses of the non-brain injured group (non-BI) to PCRS abstract items were characterized by frequent underestimation of ability (71.4% of the items), and little agreement with therapist ratings or overestimation of competency (14.3% of the items in both cases). Please see Table 3 for a summary of mean D_i scores obtained for the PCRS abstract items.

The D_i scores of brain injured and non-brain injured groups were compared by independent t-tests. The results of these t-tests were later used to group the PCRS items into two factors, one composed of critical items that significantly differentiated brain injured from non-brain injured persons, and the other composed of the non-differentiating items. Group variances of the BI and non-BI groups were compared and found to be approximately equivalent, despite differences in group size. The BI and non-BI groups differed significantly (α=0.05) in their responses to 7 of the 30 PCRS items. Examination of the mean scores of the two groups for these critical items revealed that the BI group either overestimated its ability or agreed with therapist rating, while the non-BI group underestimated its ability on each one.

The following is a list of the critical items that differentiate between the BI and non-BI groups:

I. **PCRS1** (concrete): Preparing own meals ($t(46)=2.29$, $p=0.03$)

II. **PCRS2** (concrete): Dressing self ($t(47)=2.87$, $p<0.01$)

III. **PCRS4** (concrete): Washing dishes ($t(47)=2.09$, $p=0.04$)

IV. **PCRS6** (concrete): Taking care of own finances ($t(47)=2.52$, $p=0.02$)

V. **PCRS7** (concrete): Keeping appointments on time ($t(47)=2.02$, $p=0.05$)

VI. **PCRS17** (abstract): Handling arguments with people who are well known to the individual ($t(41)=2.05$, $p=0.05$)

VII. **PCRS24** (concrete): Understanding new instructions ($t(44)=2.19$, $p=0.03$)

Figures 1 and 2 illustrate BI and non-BI levels of awareness for each PCRS item. Impaired awareness is indicated by D_i values greater than the absolute value of zero. Figure 1 shows the mean D_i scores of each PCRS item, by group. Figure 2 presents the between-group differences in mean D_i scores.

Revised Ways of Coping questionnaire (WOC-R). Averaged raw scores were calculated for WOC-R scales by summing the item scores of each scale and dividing this total by the number of scale items for which responses were provided. These averaged raw scores were used in independent t-tests to compare the methods of coping used by the BI (n=31) and non-BI (n=15) groups. Group variances of the BI and non-BI groups were compared and found to be approximately equivalent, despite differences in group size. The two groups differed in a statistically significant manner in their scores on the scales of Confrontive Coping ($t(44)=-2.14$, $p=0.04$) and Planful Problem Solving ($t(44)= -2.82$, $p<0.01$). Closer examination of these differences revealed that the mean scores of the BI group were lower for both scales than were those of the non-BI group. Please see Figure 3 for an illustration of the differences in group responses for each WOC-R scale.

A relative score for each WOC-R scale was calculated for each by dividing each summary scale score by the sum of raw scores for all scales. This calculation provided descriptive information regarding the proportion of effort devoted to the use of each coping strategy during a stressful encounter. The relative scores of the BI group ranged from 0.09 (Accepting Responsibility) to 0.16 (Seeking Social Support), and those of the non-BI group ranged from 0.10 (Escape-Avoidance and Positive Reappraisal) to 0.14 (Planful Problem Solving and Confrontive Coping). Figure 4 illustrates the proportionate use of coping strategies of the two groups, and Table 4 provides a summary of group mean scale scores.

Critical item and coping scale correlations. The critical items of the PCRS (those found to differentiate between the BI and non-BI groups) were examined in relation to each WOC-R scale. Partial correlations were made, in order to control for the effects of any between-group differences as detected by the preceding independent t-tests. These analyses produced five statistically significant moderate correlations ranging from -0.38 to 0.44. The following is a list of the associated items and coping scales:

I. **PCRS1** (preparing own meals) and **Positive Reappraisal** ($r(25)=-0.43$, $p=0.03$)
II. **PCRS 4** (washing dishes) and **Positive Reappraisal** ($r(25)=-0.41$, $p=0.03$)
III. **PCRS4** (washing dishes) and **Seeking Social Support** ($r(25)=-0.39$, $p=0.05$)
IV. **PCRS6** (taking care of own finances) and **Accepting Responsibility** ($r(25)=0.44$, $p=0.02$)
V. **PCRS17** (handling arguments) and **Distancing** ($r(25)=-0.38$, $p=0.05$)

Four of the above associations indicate negative relationships between critical item D_i scores and coping strategies. Negative correlations suggest that as the degree of overestimation of ability for a PCRS critical item increased, the use of the related coping strategy decreased, and as the degree of underestimation of ability for the item increased, coping strategy use increased. One of the associations was in the positive direction, indicating that as the degree of overestimation of ability for that critical item increased, use of the related coping strategy likewise increased. In contrast, as the degree of underestimation of ability for the item increased, use of the coping strategy decreased. Figure 5 illustrates the correlation coefficients (r) between critical items and coping scales.

Additional analyses. The small sample size ($n=49$) used in this study served to limit the number of possible statistical analyses that could be conducted without

dramatically increasing the likelihood of type I statistical error. For this reason, the independent t-tests used to evaluate the original hypotheses of the study constitute the primary focus of our analyses. Since a graduate thesis is a useful tool for conducting exploratory research, additional t-tests and correlational analyses (controlling for brain injury) have been included in an attempt to investigate more fully the phenomenon of impaired awareness following brain injury. Caution should be exercised when interpreting the results of these analyses, given the possibility of type I error.

The first of the additional analyses was conducted to determine whether organically based impaired awareness is more likely to be associated with PCRS items assessing concrete or abstract areas of functioning. Each subject's D_i scores for concrete and abstract PCRS items were totaled to produce scale scores for these two types of items. Concrete scale scores (D_C) were calculated by adding the D_i values of PCRS items 1,2,3,4,5,6,7,9,10,11,12,13,14,22 and 24, while Abstract scale scores (D_A) were calculated by summing the D_i values of the remaining PCRS items (items 8,15,16,17,18, 19,20,21,23,26,27,28,29,30). BI and non-BI Concrete and Abstract scale scores were compared using independent t-tests. Group variances of the BI and non-BI groups were compared and found to be approximately equivalent, despite differences in group size. As can be seen from the mean scores for each scale (Table 5), while the BI group overestimated its ability on both types of items, and that the greatest subject-rater discrepancy occurred for the Concrete scale. In contrast, the non-BI group underestimated its ability on both scales, and differed most from third party ratings on the Abstract scale.

Independent t-tests comparing BI and non-BI group scores on the awareness scales revealed no significant differences for Abstract scores. Concrete scores however,

differed between the two groups ($t(30)=3.42$, $p<0.01$) such that the BI group overestimated (and the non-brain injured group underestimated) its ability on the scale items. Neither the Abstract nor Concrete scale was significantly correlated with any WOC-R scale.

The eight coping scales of the WOC-R were also dichotomized (as Denial or No Denial) for the purpose of exploratory analysis. Classification was based on my own judgment regarding the degree to which each scale reflected the use of escape, avoidance or threat minimization during stressful encounters. Denial scores (Den) were calculated by adding raw scores for the Escape-Avoidance and Distancing scales, while No Denial scores (NDen) were calculated by summing the raw scores of the remaining WOC-R scales (Confrontive Coping, Self-Controlling, Seeking Social Support, Accepting Responsibility, Planful Problem Solving and Positive Reappraisal). A between-group comparison of the Denial and No Denial scale scores was conducted to determine whether brain injury is associated with either type of pre-morbid coping style. Table 6 displays the mean values obtained by BI and non-BI groups on the Denial and No Denial scales.

The BI and non-BI groups differed significantly in their No Denial scores ($t(44)=-2.59$, $p=0.01$). Examination of group means revealed that the BI group scored lower on the No Denial scale than the non-BI group, suggesting that the non-BI group was more likely to use coping strategies than was the BI group. Neither Denial or No Denial scores were significantly related to the critical items or derived (Abstract and Concrete) scales of the PCRS. Examination of Denial and NoDenial scales in relation to PCRS non-critical items (items not found to differentiate between the BI and non-BI groups) revealed the following moderate, statistically significant relationships :

I. **Denial** and **PCRS21**(abstract): Showing affection to people ($r(25)=-0.48$, $p=0.01$)

II. **Denial** and **PCRS30** (abstract): Controlling laughter ($r(25)=-0.45$, $p=0.02$)

III. **No Denial** and **PCRS20** (abstract): Acting appropriately when around friends ($r(25)= -0.38$, $p=0.05$)

Correlational analyses between individual WOC-R scales and non-critical PCRS items were also conducted. Whereas the Denial/NoDenial correlations with non-critical items were all negative, the individual scale analyses produced eight moderate correlations ranging from -0.57 to 0.45 ($\alpha=0.05$). The following is a list of these associations:

I. **Distancing** and **PCRS16** (abstract): Adjusting to unexpected changes ($r(25)=-0.40$, $p=0.04$)

II. **Distancing** and **PCRS21** (abstract): Showing affection to people ($r(25)=-0.48$, $p=0.03$)

III. **Distancing** and **PCRS30** (abstract): Controlling laughter ($r(25)=-0.46$, $p=0.02$)

IV. **Self-Controlling** and **PCRS12** (concrete): Remembering daily schedule ($r(25)=0.45$, $p=0.02$)

V. **Seeking Social Support** and **PCRS11** (concrete): Remembering the names of people seen often ($r(25)=0.44$, $p=0.02$)

VI. **Seeking Social Support** and **PCRS30** (abstract): Controlling laughter ($r(25)=0.40$, $p=0.04$)

VII. **Accepting Responsibility** and **PCRS8** (abstract): Starting a conversation in a group ($r(25)=0.42$, $p=0.03$)

VIII. **Escape Avoidance** and **PCRS12** (concrete): Remembering daily schedule ($r(25)= -0.57$, $p<0.01$)

IX. **Planful Problem Solving** and **PCRS 20** (abstract): Acting appropriately when around friends ($r(25)=-0.41$, $p=0.03$)

X. **Positive Reappraisal** and **PCRS11** (concrete): Remembering the names of people seen often ($r(25)=0.44$, $p=0.02$)

Figures 6 and 7 illustrate these findings. Figure 6 indicates that 75.0% of the correlations involving concrete PCRS items were positive. Figure 7 shows an equal frequency of positive and negative correlations for abstract items. Positive correlations indicate that as the degree of overestimation of ability for the PCRS item increased, use of the coping strategy also increased, while as the degree of underestimation of ability on the item increased, coping strategy use decreased. Negative correlations indicate that as the degree of overestimation of ability for the PCRS item increased, use of the coping strategy decreased, while as the degree of underestimation of ability on the item increased, coping strategy use increased. Both figures indicate that all correlations involving the WOC-R scales of Distancing and Escape-Avoidance (assessing denial behaviours and cognitions) were negative.

Discussion

Critical items. The results of this study support the contention that the Patient Competency Rating Survey (PCRS) contains several critical items that may be used to differentiate between individuals with and without an organic basis for impaired awareness. The concrete items assessing awareness of deficits in preparing meals

(PCRS1), dressing oneself (PCRS2), washing dishes (PCRS4), taking care of finances (PCRS6), keeping appointments on time (PCRS7) and understanding new instructions (PCRS24) were identified as critical items, capable of differentiating between the brain injured and non-brain injured groups. In addition, the abstract item assessing awareness of deficits in handling arguments with people who are well known to the individual (PCRS17) was able to differentiate between the brain injured and non-brain injured groups. All of the critical items are characterized by behaviours that are relatively easy to perform, a finding that is consistent with the notion that any impaired awareness associated with them is due to a mismatch between perception of the efforts required for task completion and personal efficacy at putting forth and achieving success with these efforts.

The level of competency on all critical items reported by individuals with brain injury indicated an overestimation of ability, or lack of awareness of deficits. This finding is consistent with the work of Prigatano, et al. (1990), who found that brain injured individuals typically overestimate their ability on ten PCRS items. Three of the critical items capable of differentiating brain injured from non-brain injured individuals (PCRS6, PCRS17 and PCRS24), were among the ten items identified by Prigatano and colleagues (1990). In contrast, any impaired awareness on the part of non-brain injured individuals was characterized by underestimation of ability. (Similar findings occurred for the Concrete scale of the survey, and were likely due to the additive statistical effects of the concrete critical items.) These differential patterns of responding indicate that while the brain injured group may not realize the full extent of injury-related variables on personal competency, the non-brain injured group is very aware of such limitations.

The non-brain injured group's consistent underestimation of self-competency on PCRS critical items is quite interesting, and merits comment. In contrast to the subject-

rater discrepancies of the brain injured group, third party ratings of the non-brain injured group were higher than were self-ratings on all PCRS critical items. This suggests that if the response patterns of the brain injured group indicate a lack of awareness of deficits, that of the non-brain injured group indicates a lack of awareness of ability! The fact that no organic basis of impaired awareness existed in the non-brain injured group leads to the speculation that a factor other than a damaged neuropsychological mechanism is involved in this consistent underestimation of ability.

Research conducted with subjects epidemiologically similar to the members of this study's non-brain injured group has demonstrated that emotional reactions and attributional style may influence psychosocial well-being and adjustment to long-term illness (Strickland, 1989). Dejection, depression and feelings of futility have all been observed in patients recovering from spinal cord injury, and have been reported to impede rehabilitation when profound (Moore & Patterson, 1993; Stambrook et al., 1991). These findings offer tentative support for the suggestion that the low self-competency ratings of the non-brain injured individuals on critical items are due to emotional and attributional factors. Since the focus of this study is impaired awareness following brain injury, its findings will be discussed as they relate to lack of awareness of deficits (characteristic of the brain injured group) rather than underestimation of true ability.

Six of the Patient Competency Rating Survey critical items pertained to concrete self-directed and goal oriented behaviour. Ability to succeed at the tasks assessed by these items may be influenced by an number of factors, including motor function, motivation and comprehension of desired outcome. Impaired ability to complete the tasks may result from deficits in any of these areas, but is unlikely to be a threat to the individual's senses of self-identity or psychological well-being. The tasks assessed by the concrete critical items refer to practical every-day behaviours and cognitions for which deficits in ability are

likely to have little more psychosocial impact on the individual than to cause him/her frustration and inconvenience.

It follows logically, that impaired awareness of deficits for these less-threatening areas of functioning is due erroneous self-monitoring, rather than a psychological reaction intended to reduce anxiety. The consistent overestimation of competency on critical items by the brain injured group (relative to the non-brain injured group) supports the idea that psychological factors are not solely responsible for the observed subject-rater discrepancies of competency. Non-brain injured individuals (even those who gave inaccurate reports of competency) had not sustained the physical trauma believed to lead to damaged feedback loops responsible for organic Anosognosia. It is therefore likely that items differentiating their responses from those of brain injured individuals reflect an organic causal mechanism. These findings are consistent with Heilman's (1991) hypothesis that damaged monitoring and feedback mechanisms are responsible for some cases of Anosognosia.

The final PCRS critical item identified in the study involved the more abstract domain of 'handling arguments'. As was the case for the other critical items, the brain injured group (in comparison to the non-brain injured group) overestimated its level of competency in this area. An organically based explanation of this finding may at first seem counterintuitive, but upon closer examination, is likely correct. One would expect emotional distress (including anxiety) to be associated with a brain injured person's arguments with people he/she knows well, and consequently the impaired awareness of ability to handle arguments to result from psychological denial, rather than purely organic factors.

The difference in awareness levels of brain injured and non-brain injured groups for this item indicates that despite the potential influence of psychological factors, organic factors are extremely important in awareness of deficit in this area of functioning. Arguments involve the interplay of emotion, cognitions and behaviours, and successfully handling them requires an individual to monitor his/her own functioning in these domains as well as to react appropriately to the person with whom the conflict is occurring. Damaged feedback loops may interfere with the accuracy of this self-monitoring, thus the individual may behave inappropriately (as observed by an objective third party) during the argument. The organic mechanism that causes impaired ability to participate in the argument process may also cause some of the impaired awareness of deficit in ability to handle the argument's consequences.

Coping. Differences in the coping styles of brain injured and non-brain injured individuals were unexpected and the fact that they were found warrants comment. The largest proportion of coping efforts of the brain injured group was represented by the strategy of seeking social support. The scale assessing this strategy contains items describing efforts to seek informational, tangible and emotional support (Folkman & Lazarus, 1988). The largest proportion of coping efforts among members of the non-brain injured group was equally divided between the planful problem solving and confrontive coping strategies. The scale assessing planful problem solving describes deliberate problem-focused efforts to alter the situation, coupled with and analytic approach to solving the problem. The Confrontive Coping scale's items describe aggressive efforts to alter the situation and suggest some degree of hostility and risk taking (Folkman & Lazarus, 1988). The raw scores of the brain injured and non-brain injured groups were found to differ significantly for the Confrontive Coping and Planful Problem Solving scales.

The WOC-R was selected as an independent coping measure based on the assumption that pre-morbid coping patterns were not likely to be significantly associated with the probability of sustaining brain injury in the future. Coping patterns were expected be normally distributed among the subjects of this study, and no significant between-group differences in coping style were anticipated. It is possible that the observed differences in coping between the brain injured and non-brain injured groups were due to the manner in which the WOC-R was used in this study. The WOC-R was originally designed as a self-report measure of coping efforts used during a recent stressful encounter. Our use of the instrument was quite different from this, and may have adversely affected its properties as an assessment tool.

The WOC-R was used in this study to solicit a report of each subject's coping styles from one of his/her relatives or significant others in order to eliminate Anosognosia-related biases that might have occurred if the WOC-R were had been used as a self-report. While it may have been somewhat useful in this regard, soliciting responses from significant others/relatives proved problematic in that many respondents were unable to answer items pertaining to subjects' internal cognitive processes. In particular, the items of the Escape-Avoidance and Positive Reappraisal scales were unanswerable to many respondents. Although it is probably true that post-injury impaired awareness impacts on the accuracy of self-assessments of coping strategy use, it is equally probable that the method of data collection used in the current study may have biased responses to questionnaire items. Relatives/significant others were only able to comment on subjects' use of cognitive coping strategies that had been discussed or acted upon, thus the current assessment method may have provided an independent measure of 'acting on cognitions' or 'interpersonal communication' rather than of the coping strategies *per se*. These questionnaire response biases do not account fully for between-group differences in coping styles, since one would expect that the pre-morbid coping methods of 'acting on

cognitions' and 'interpersonal communication' would vary normally among the subjects of both groups in the study.

A more likely explanation for the between-group differences in coping may be that the quality of the respondent-subject relationship at the time of data collection and retrospective biases (including accuracy of memory and relationship quality during of the stressful situation) may have influenced WOC-R scores. Research has demonstrated that family and marital relationships often change markedly following brain injury (Oddy, 1984; Peters, Stambrook, Moore, & Esses, 1990). In addition, comparison of marital quality following spinal cord injury and head injury has indicated a greater degree of marital dissatisfaction among the spouses of head injured subjects relative to those of subjects recovering form spinal cord injury (Peters et al., 1992). Taken in combination, these findings suggest that the relationship quality between brain injured subjects and their respective WOC-R respondents may have been adversely influenced by the psychosocial sequelae of brain injury. This influence may be partially responsible for retrospective biases that led to lower Confrontive Coping and Planful Problem Solving scale ratings of the brain injured group relative to the non-brain injured group.

The fact that between-group differences were found only for two WOC-R strategies indicates that they may be qualitatively different from the other six coping strategies in the questionnaire. (Note that the between-group difference for the No Denial method of coping is likely due to the additive statistical effects of the two scales differentiating between the two groups.) The content of the Confrontive Coping and Planful Problem Solving scales are distinct from other scales in that they involve realistic acknowledgment of the relevant stressor, and problem-focused efforts to alter its stressful effects. Realistic appraisal and planned behaviour are two aspects of cognitive functioning that are commonly impaired following brain injury, therefore the retrospective accounts of

the relatives/significant others of subjects with such deficits may have been biased towards ratings of infrequent pre-injury use of these strategies, despite the fact that they may have been employed.

A second change in the administration procedure typically used with the WOC-R may also have contributed to the observed between-group differences in coping patterns. During our study, each respondent was requested to answer the questionnaire items as they related to a stressful encounter that occurred before the injury leading to hospitalization. This procedural change was implemented in an attempt to eliminate the confounding effects of any post-injury impairment of awareness on coping strategy use. This procedure may seem grounded in logic, but assessing an individual's coping processes during a pre-morbid stressful encounter (in some cases the incident had occurred several years ago), proved problematic. Respondents frequently reported that they did not have a sufficiently clear memory of the situation to answer WOC-R items. A solution to the problem of inability to remember the details of pre-morbid experiences would be to use the WOC-R as it was intended by its creators, to assess a recent stressful situation (i.e.: one that occurred within the seven days preceding assessment). Although the role of brain-injury in the response of such reports cannot be completely eliminated, its effects on coping scores might be partialled out and thereby minimized during correlation analyses. In addition, the information obtained in a post-injury assessment would be useful to clinicians interested in assessing and making use of the current coping repertoires of rehabilitation clients.

Associations between critical items and coping strategies. The second objective of this study was to ensure that the PCRS critical items that differentiated brain injured from non-brain injured individuals were assessing organic, rather than psychologically based impaired awareness. To this end, correlations between the critical items and WOC-R

scales were calculated. Moderate associations were found between coping strategies and the abstract (PCRS17), and three concrete items (PCRS1, PCRS4 and PCRS6). The abstract item was negatively correlated with denial, and the three concrete critical items were associated with the use of strategies other than denial. These associations suggest that impaired awareness in areas of functioning assessed by the critical items is not motivated by a psychological defense reaction. The moderately strong relationships between PCRS critical items and these coping strategies suggest that the critical items differentiate between organically and psychologically based impairments of awareness.

The critical items assessing ability to perform the household tasks of preparing meals (PCRS1) and washing dishes (PCRS4) were associated with the coping strategy of positive reappraisal. Lack of awareness of deficits was associated with limited use of the positive reappraisal strategy, while acknowledgment of performance limitations was associated with greater use of the strategy. The coping technique of positive reappraisal involves focusing on the positive aspects of a stressful situation in an attempt to find personal meaning in it (Folkman & Lazarus, 1988). This requires the individual to perceive the situation as stressful, and to be aware of its potentially positive aspects. The negative association between impaired awareness and positive reappraisal may be the result of an individual's inability to fulfill these requirements. An organic lack of awareness may cause the individual to inaccurately perceive a situation as threatening or stressful, and the overestimation of ability characteristic of organic Anosognosia may take the form of failure to search for positive meaning in order to alleviate this stress. Limited use of positive reappraisal is therefore likely to be reflective of organically based impaired awareness.

Awareness of ability to wash dishes was also associated with a second coping strategy, that of seeking social support. As was the case for positive reappraisal, the

association between overestimation of competency and strategy use was negative. That is, high levels of overestimation of competency at washing dishes were associated with limited efforts to seek social support. Seeking social support as a coping method, involves turning to others for informational, tangible or emotional support (Folkman & Lazarus, 1988), something that can only occur once an individual recognizes that he/she is in need of assistance. Recognition of this need may not occur if an individual has sustained damage to a self-monitoring feedback mechanism (the cause of organically based impaired awareness), since he/she may neither perceive the situation as stressful, nor realize the necessity of enlisting support from others.

The final concrete critical item for which a coping strategy was associated assessed awareness of ability to take care of personal finances (PCRS6). Individuals demonstrating impaired awareness of competency in this domain, also indicated a high use of the coping strategy of accepting responsibility. This coping technique involves acknowledgment of one's role in creating a stressful encounter, and attempting to rectify the situation (Folkman & Lazarus, 1988). One might expect that impaired awareness of deficit might be negatively associated with this strategy, since impaired monitoring ability precludes acknowledgment of most problems, let alone assuming personal responsibility for their occurrence. The positive association between strategy use and lack of awareness of deficit might be explained in terms of the second component of the strategy, an attempt to rectify the problematic situation. Taking care of finances is a task that involves a great deal of responsibility, since proper financial management is a method of providing oneself with assurance of security and stability. Knowledge that finances are order is likely to provide one with a sense of comfort that his/her needs will be taken care of, even if unexpected expenses arise. Overestimation of ability to take care of one's finances and the coping mechanism of accepting responsibility are not mutually exclusive. A person who perceives him/herself as competent at taking care of finances is at the same time,

attempting to accept responsibility for his/her financial state. Organic impairments causing cognitive damage or destroying comparatory and monitoring mechanisms may result in an inability to adequately carry out the task, and to accurately perceive one's limitations in this regard. Individuals unable to recognize these limitations, but aware of the need to take care of personal finances will continue to attempt to do so (i.e.: rectify the financial situation), thus accounting for the associated increased use of the accepting responsibility strategy.

Ability to handle arguments was the only critical item associated with the distancing strategy, a type of denial. Distancing involves cognitive efforts to detach oneself and to minimize the significance of the situation (Lazarus & Folkman, 1988), thus it represents a form of deliberate denial, employed to reduce distress associated with the situation. Individuals who overestimated the appropriateness of their behaviours and responses during arguments (i.e.: the brain injured group) used the distancing strategy to a lesser degree than did individuals who acknowledged having difficulties handling arguments (i.e.: the non-brain injured group). This finding indicates that individuals who overestimated their abilities at 'handling arguments' were not prone to use the denial defense mechanism, and may be taken as further support for the study's hypothesis that the impaired awareness for critical items is not due to psychologically based factors. When examining the association between critical items and the denial strategies in this light, the association of only one critical item with the distancing strategy was somewhat unexpected, since low scores on the Distancing scale indicate a low reliance on the strategy. This may have been the by-product of statistical limitations resulting from the small sample size used in the present study.

Additional findings. Failure to find any significant correlations between gross measures of coping (Denial and NoDenial scales) and PCRS critical items was another

unexpected discovery. The Denial and No Denial scores were calculated in an attempt to facilitate associations of PCRS critical items with coping methods either indicative or not indicative of denial. The dichotomous grouping of coping strategies was based on the assumption that both distancing and escape-avoidance occur during denial, while the other WOC-R strategies are incompatible with denial. It was hypothesized that the critical items (as a result of their ability to detect organically based impaired awareness) would be unrelated to denial strategies, but would correlate with the non-denial strategies. Failure to find the correlations between critical item and No Denial may have been due to diversity among the strategies comprising the No Denial score. Each WOC-R non-denial scale measures a very distinct method of dealing with a stressful encounter, and it may have been inappropriate to treat them as members of a single group. Combining all the scales into one measure may have canceled out their individual properties and nullified any potential correlations with critical items. A more appropriate method of analysis might have been to group the non-denial strategies according to their specific characteristics (i.e.: problem-focused, emotion-focused, cognitive, behavioural, etc.) for correlations with critical items.

Analyses involving the PCRS non-critical items provides no insight into how one might differentiate between organic and psychologically based impaired awareness. Non-critical items (by definition), were unable to differentiate between the brain injured and non-brain injured groups, thus correlations with WOC-R scales provide no additional information about the mechanisms underlying impaired awareness of deficit on the items. What is interesting about non-critical items however, is the frequency with which of significant correlations between abstract PCRS items (relative to concrete items) and WOC-R scales occurred. One possible reason for this is that the cognitive processes involved in the tasks assessed by many of the non-critical items are similar to those involved in the coping methods assessed by the WOC-R scales.

General comments. The present study has generated intriguing preliminary evidence that the PCRS might be useful at detecting organic impairments in awareness. These results were found despite the fact that geographic isolation and size of the hospital facility at which the investigation was conducted prevented access to large samples of homogeneous subjects. The discovery of results confirming our original predictions may be due in part to the two main strengths of the study presented below.

As indicated by the findings of the pilot study, the inter-rater reliability of pooled test clients was high. The between-rater variability displayed for individual test client assessments seems to have been due to a lack of previous contact between rater and test client (this was compensated for in the main study by having only those raters most familiar with subjects complete third party PCRS forms). Since pilot study rating systems were maintained for use during data collection in the main study, the critical items identified in the main study were assessed reliably.

A second strength of the study is the diagnostic accuracy that was involved in classifying individuals as brain injured or non-brain injured. All subjects had received medical and neuropsychological diagnoses regarding the nature of their injuries prior to participating in the study. The expertise of the diagnosticians, and the strict nature of the criteria used to make such diagnoses suggests that the two groups of individuals were composed purely of brain injured or non-brain injured individuals. The observed between-group differences in post-injury awareness, are therefore likely to truly reflect the role of organic factors in impaired awareness.

The results of the current study are interesting and represent an initial step towards understanding the respective roles of psychology and biology in Anosognosia. The

discovery that it may be possible to differentiate organic awareness from denial is very exciting, but questions concerning the roles of self-esteem, mood and the quality of interpersonal relationships on awareness and coping may also need to be considered when assessing the nature of Anosognosia. In addition to exploring these issues, a larger scale replication of the current study is necessary in order to ensure the cross-sample validity of its results.

There are two weaknesses in the current study that may have affected its outcome, and should be improved upon prior to attempts at replication. The first of these involves the data collection process, and the second involves the manner in which the independent measure of coping was obtained. Since the problems associated with WOC-R administration have already been discussed, let us turn our attention to the difficulties encountered during data collection.

The WOC-R and the client version of the PCRS were both collected by the Lakehead University Master of Arts student responsible for the bulk of the study. Because of the clinical nature of the research, and interest in incorporating any relevant findings into treatment programmes at St. Joseph's General Hospital, the third party version of the PCRS was completed by each subject's primary occupational therapist during the course of a typical therapy session. The occupational therapists agreed to this method of data collection, since assessment of a client's level of functioning is an integral part of the occupational therapy process. Despite the straightforward nature of this data collection procedure, a few problems occurred as a result of occupational therapist involvement. The primary occupational therapist of each subject was asked to complete the third party version of the PCRS within a few days of the subject's self rating. This procedure was intended to ensure that both ratings occurred at approximately the same point in the rehabilitation process, so that any subject-rater discrepancies would be

reflective of impaired awareness rather than therapeutic, interpersonal or contextual changes that may have occurred between the self and therapist rating sessions. Therapist ratings were generally completed in a timely fashion. Towards the end of the data collection period however, there were a number of instances in which ratings were made several weeks after the client self-rating was obtained. Although it is unclear how these delays affected results, it was still possible to detect critical items in spite of this complication.

Implications and directions for future research. The main implication arising from the study's findings is that it may be possible to use a psychometric measure of awareness to distinguish between organic and psychological Anosognosia. The results of the study indicate that administration of the PCRS to rehabilitation clients may enable clinicians to classify individuals according to the nature of impaired awareness following brain injury. As is the case with any psychometric instrument, PCRS findings should not be considered in isolation, but in the context of all other available sources of information. Responses to the critical items of the PCRS should be used only as a supplement to clinical judgment when classifying Anosognosia and formulating treatment plans.

A second implication of the of the findings is that large samples of homogeneous subjects may not be necessary for exploratory investigations of neuropsychological phenomena. Our use of a small number of subjects appears to have been able to provide preliminary evidence regarding classification of Anosognosia. Replication of the current study with a larger sample and controlling for variables such as phase of recovery, severity of injury and medical diagnosis is necessary however, prior to making conclusive statements about the extent of clinical utility of the PCRS.

A third implication is that the PCRS may be suitable for use with a variety of brain injured individuals. The results of the present study suggest that the instrument may be used to assess awareness in cases of traumatic brain injury, closed head injury, degenerative neurological disease and CVA. The versatility of the PCRS as an assessment instrument has the potential to eliminate the frustration associated with assessing and making clinical judgments about individuals with one type of injury, using psychometric instruments originally designed for use with a slightly different clinical population.

The current version of the PCRS is far from ideal as an assessment instrument, and requires considerable refinement of its item content in order to increase its sensitivity at differentiating forms of altered awareness. The seven critical items identified by the present investigation may not be the only items able to differentiate between organically and psychologically based impaired awareness, but may have been detected as such because of the nature of the areas of functioning they assess. The critical items were concerned with competency at discrete goal directed activities or observable behaviours, the success of which were measurable in terms of the degree to which the goals were attained.

Most of the non-critical items required the third party rater to make judgments regarding a subject's level of competency without specifying the criteria necessary for success in that particular area of functioning. The difficulties associated with this ambiguity are exemplified by third party ratings for PCRS21, an abstract item assessing the individual's ability to demonstrate affection to others. A third party rater evaluating a subject's ability in this area is required to do so without the aid of an operational definition of success or failure at the task. This makes it conceivably possible for individuals who have difficulty expressing themselves verbally and those who are emotionally

overcontrolled to receive similar competency ratings despite obvious differences in the degree to which organic or psychological causal mechanisms may be involved.

Third party competency ratings are used in the calculation of awareness scores, thus ratings made without considering the nature of impairment responsible for competency level are likely to impact on the ability of the PCRS to differentiate between types of altered awareness following brain injury. In the case of PCRS21, to make further use of this example, failure to specify the criteria for success or failure may cause a person with Aphasia (for which Anosognosia is generally accepted to be organically based) and one who is threatened by overt displays of emotion (may involve organic or psychological components) to receive identical awareness scores on the item. Operationalization of success and failure in each area of functioning assessed by the PCRS is necessary in order to clarify the rating criteria, so that the diagnostic utility of the instrument may be improved. A suggested area of future research is to specify the criteria used as the basis of third party ratings for each PCRS item, and to examine whether using such criteria leads to identification of more critical items capable of differentiating between brain injured and non-brain injured subjects.

A second way to improve the discriminatory power of the PCRS might be to change its administration procedure from that used in the current study. Many of the non-critical items assess interpersonal functioning. Since most rater-subject contact occurred during the course of therapy, it unlikely that the third party ratings of interpersonal behaviours were entirely accurate. Therapists may only be suitable as third party raters for items assessing functional behaviours, since their judgments regarding interpersonal behaviours are limited to what has been observed during therapy sessions. The results of our pilot study indicate that consistent methods of assessment were used by the occupational therapists, but it may be that the ratings given for interpersonal functioning

were biased because of the professional nature of the therapeutic relationship. It might be more appropriate to enlist the help of individuals more closely involved with clients (i.e.: family members/significant others) to assess interpersonal functioning. The results of previous research suggests that family members are useful as third party raters, although they typically overestimate competency (in comparison to therapist ratings) on PCRS functional items (Prigatano et al., 1986). An intriguing topic for future research would be to compare the PCRS critical items identified when occupational therapists and relatives function as the third party rater of subject competency. This type of research might reveal some interpersonal areas of functioning that are useful in identifying organically based impaired awareness.

A final issue regarding the utility of the PCRS as a diagnostic instrument is the complexity of some of the tasks used to assess competency. The difficulties with this aspect of the instrument are particularly evident for non-critical items, but the critical item assessing ability to handle arguments (PCRS17) also illustrates the ambiguity associated with items that tap into more than one area of functioning. Psychological components (i.e.: emotional reactions, cognitive processing etc.) and organic monitoring both influence an individual's ability to handle arguments, and thus may both influence his/her awareness of deficit in this area of functioning. This interaction of biological and psychological factors makes it difficult to definitively determine whether a subject-therapist discrepancy on PCRS17 is the manifestation of either an organic or psychological impairment in awareness. A suggestion for improvement to the utility of the PCRS at differentiating the two kinds of awareness is to refine the complex items by dividing them into components that assess the psychological and organic aspects of the behaviour. A suggested area of future research is to decompose each PCRS item into its component areas of functioning, and to examine each of these components in relation to its ability to differentiate between groups of brain injured and non-brain injured subjects.

Conclusion

In summary, this exploratory study endeavoured to determine whether brain injury-related impairments of awareness maybe differentiated on the basis of the involvement of organic or psychological factors. The results point to the potential utility of the Patient Competency Rating Survey at identifying organic Anosognosia. Further research with the PCRS is needed if it is to be developed into a sophisticated and reliable instrument for use in evaluating altered awareness following brain injury. It is our hope that continued research efforts, such as those outlined above, will eventually enable clinicians to more accurately assess and more effectively treat Anosognosia.

References

Alajouanine, T. (1956). Verbal realization in aphasia. Brain, 79, 1-28.

Alexander, M.P., Stuss, D.T., & Benson, D.F. (1979). Capgras syndrome: A reduplicative phenomenon. Neurology, 29, 334-339.

Baars, J.B., & Banks, W.P. (1992). Introduction: The evidence for Anosognosia. Consciousness and Cognition, 1, 148-151.

Baretz, R.M., & Stephenson, G.R. (1976). Unrealistic patient. New York State Journal of Medicine, January, 54-57.

Benson, D.F. (1973). Psychiatric aspects of aphasia. British Journal of Psychiatry, 123(576), 555-566.

Biaschi, E., Vallar, G., Perani, D., Papagno, C., & Berti, A. (1986). Unawareness of disease following lesions of the right hemisphere: Anosognosia for hemiplegia and Anosognosia for hemianopia. Neuropsychologia, 24(4), 471-482.

Bond, M. (1984). The psychiatry of closed head injury. In N. Brooks (Ed.), Closed Head Injury: Psychological, social and family consequences (pp. 148-178). Oxford: Oxford University Press.

Brooks, N. (1984). Head injury and the family. In N. Brooks (Ed.), Closed Head Injury: Psychological, social and family consequences (pp. 123-147). Oxford: Oxford University Press.

Caplan, A.L., Callahan, D., & Haas, J. (1987). Ethical and policy issues in rehabilitation medicine. Hastings Center Reports (suppl.), 1-20.

Cutting, J. (1978). Study of Anosognosia. Journal of Neurology, Neurosurgery and Psychiatry, 41, 548-555.

David, A., Owen, A.M. & Förstl, H. (1993). An annotated summary and translation of "On the self-awareness of focal brain diseases by the patient in cortical blindness and cortical deafness" by Gabriel Anton (1899). Cognitive Neuropsychology, 10(3), 263-272.

Deaton, A.V. (1986). Denial in the aftermath of traumatic head injury: Its manifestations, measurement, and treatment. Rehabilitation Psychology, 31(4), 231-240.

Dorpat, T.L. (1983). The cognitive arrest hypothesis of denial. International Journal of Psycho-Analysis, 64, 47-58.

Douglas, C.J., & Druss, R.G. (1987). Denial of illness: A reappraisal. General Hospital Psychiatry, 9, 53-57.

Feher, E.P., Mahurin, R.K., Inbody, S.B., Crook, T.H., & Pirozzolo, F.J. (1991). Anosognosia in Alzheimer's Disease. Neuropsychiatry, Neuropsychology, and Behavioral Neurology, 4(2), 136-146.

Folkman, S.; & Lazarus, R.S. (1988). Ways of Coping Questionnaire sampler set. Manual, test booklet, scoring key. Palo Alto: Consulting Psychologists Press.

Folkman, S.; Lazarus, R.S.; Dunkel-Schetter, C.: DeLongis, A.; & Gruen, R.J. (1986). Dynamics of a stressful encounter: Cognitive appraisal, coping, and encounter outcomes. Journal of Personality and Social Psychology, 50(5), 992-1003.

Folkman, S.; Lazarus, R.S.; Gruen, R.J.; & DeLongis, A. (1986) Appraisal, coping health status and psychological symptoms. Journal of Personality and Social Psychology, 50(3), 571-579.

Forchuk, C.; & Westwell, J. (1987). Denial. Journal of Psychosocial Nursing, 25(6), 9-13.

Förstl, H., Owen, A.M., & David, A.S. (1993). Gabriel Anton and "Anton's Symptom": On focal diseases of the brain which are not perceived by the patient (1898). Neuropsychiatry, Neuropsychology and Behavioral Neurology, 6(1), 1-8.

Freud, A. (1936). The ego and the mechanisms of defense (1996 ed.). New York: International Universities Press.

Gainotti, G., Caltagrione, C., & Miceli, G. (1977). Poor performance of right brain-damaged patients on raven's coloured matrices: Derangement of general intelligence or of specific abilities? Neuropsychologia, 15, 675-680.

Geshwind, N. (1965a). Disconnexion syndromes in animals and man. Brain, 88, 237-294.

Geshwind, N. (1965b). Disconnexion syndromes in animals and man. Brain, 88, 585-644.

Head, H., & Holmes, G. (1911). Sensory disturbances from cerebral lesions. Brain, 34, 102-254.

Hécaen H., & Albert, M. (1978). Human Neuropsychology. New York: Wiley.

Heilman, K.M. (1991). Anosognosia: Possible neuropsychological mechanisms. In G.P. Prigatano & D.L. Schacter (Eds.), Awareness of deficit after brain injury: Clinical and theoretical issues (pp. 53-62). New York: Oxford University Press.

Heilman, K.M., & Valenstein E. (Eds.). (1985). Clinical Neuropsychology. New York: Oxford University Press.

Kihlstrom, J.F, & Tobias, B.A. (1991). Anosognosia, consciousness and the self. In G.P. Prigatano & D.L. Schacter (Eds.), Awareness of deficit after brain injury: Clinical and theoretical issues (pp. 198-222). New York: Oxford University Press.

Krantz, J.L. (1992). Psychosocial aspects of vision loss associated with head trauma. Journal of the American Optometric Association, 63(8), 589-591.

Labaw, W.L. (1969). Denial inside out: Subjective experience with Anosognosia in closed head injury. Psychiatry, 32, 174-191.

Lazarus, A.A. (1980). The practice of multimodal therapy. New York: McGraw-Hill.

Lazarus, R.S. (1977). Patterns of adjustment. New York: McGraw-Hill.

Lazarus, R.S., & Folkman, S. (1984). Coping and adaptation. In W.D. Gentry (Ed.), The handbook of behavioral medicine (pp. 282-325). New York: Academic Press.

Levine, D.N., Calvanio, R., & Rinn, W.E. (1991). The pathogenesis of Anosognosia for hemiplegia. Neurology, 41, 1770-1781.

Mesulam, M.M. (1986). Frontal cortex and behavior. Annals of Neurology, 19, 320-325.

Miller, F. (1977). Denial: A contribution to psychoanalytic theory. Journal of the American Academy of Psychoanalysis, 5(2), 187-193.

Moore, A.D., & Patterson, D.R. (1993). Psychological intervention with spinal cord injured patients: Promoting control out of dependence. SCI Psychosocial Processes, 6,18-24.

Moore, A.D., & Stambrook, M. (1992). Coping strategies and locus of control beliefs following traumatic brain injury: Relationship to long-term outcome. Brain Injury, 6, 89-94.

Moore, A.D., & Stambrook, M. (1994). Coping following traumatic brain injury (TBI): Derivation and validation of TBI Sample Ways of Coping-Revised Subscales. Canadian Journal of Rehabilitation, 7(3), 193-200.

Moore, A.D., Stambrook, M., & Gill, D.G. (1994). Coping patterns associated with long-term outcome from traumatic brain injury among female survivors. Neurorehabilitation, 4(2), 122-129.

Moore, A.D., Stambrook, M., & Peters, L.C. (1989). Coping strategies and adjustment after closed-head injury: A cluster analytic approach. Brain Injury, 3(2), 171-175.

Moore, A.D., Stambrook, M., Peters, L.C., Cardoso, E.R., & Kassum, D.A. (1990). Long-term multi-dimensional outcome following isolated traumatic brain injuries and traumatic brain injuries associated with multiple trauma. Brain Injury, 4(4), 379-389.

Moore, A.D., Stambrook, M., & Wilson, K.G. (1991). Cognitive moderators in adjustment to chronic illness: Locus of control beliefs following traumatic brain injury. Neuropsychological Rehabilitation, 1(3), 185-198.

Myslobodsky, M.S. (1986). Anosognosia in Tardive Dyskinesia: "Tardive Dysmentia" or "Tardive Dementia"?. Schizophrenia Bulletin, 12(1), 1-6.

Naugle, R.I. (1988). Denial in rehabilitation: Its genesis, consequences, and clinical management. Rehabilitation Counseling Bulletin, 31, 218-231.

Nockleby, D.M., & Deaton, A.V. (1987). Denial versus distress: Coping patterns in post head trauma patients. The International Journal of Clinical Neuropsychology, 9(4), 145-148.

Oddy, M. (1984). Head injury and social adjustment. In N. Brooks (Ed.), Closed Head Injury: Psychological, social and family consequences (pp. 108-122). Oxford: Oxford University Press.

O'Mahoney, P.D. (1982). Psychiatric patient denial of mental illness as a normal process. British Journal of Psychology, 55, 111-118.

Peters, L.C., Stambrook, M., Moore, A.D., & Esses, L. (1990). Psychosocial sequelae of closed head I jury: Effects on the marital relationship. Brain Injury, 4(1), 39-47.

Peters, L.C., Stambrook, M., Moore, A.D., Zubek, E., Dubo, H., & Blumenschein, S. (1992). Differential effects of spinal cord injury and head injury on marital adjustment. Brain Injury, 6(5), 461-467.

Prigatano, G.P. (1986). Personality and psychosocial consequences of brain injury. In G.P. Prigatano with D.J. Fordyce, H.K. Zeiner, J.R. Roueche, M. Pepping, & B.C.

Wood. (Eds.), Neuropsychological rehabilitation after brain injury (pp. 18-28). Baltimore: Johns Hopkins University Press.

Prigatano, G.P. (1988). Anosognosia, delusions, and altered self-awareness after brain injury: A historical perspective. BNI Quarterly, 4, 40-48.

Prigatano, G.P. (1991). Disturbances after traumatic brain injury. In G.P. Prigatano & D.L. Schacter (Eds.), Awareness of deficit after brain injury: Clinical and theoretical issues (pp. 111-126). New York: Oxford University Press.

Prigatano, G.P. (1996). Behavioral limitations TBI patients tend to underestimate: A replication and extension to patients with lateralized cerebral dysfunction. The Clinical Neuropsychologist, 10(2): 191-201.

Prigatano, G.P., Altman, I.M., & O'Brien, K.P. (1990). Behavioral limitations that traumatic-brain injured patients tend to underestimate. The Clinical Neuropsychologist, 4(2): 163-176.

Prigatano, G.P., & Fordyce, D.J. (1986a). Cognitive dysfunction and psychosocial adjustment after brain injury. In G.P. Prigatano with D.J. Fordyce, H.K. Zeiner, J.R. Roueche, M.Pepping, & B.C. Wood. (Eds.), Neuropsychological rehabilitation after brain injury (pp. 1-17). Baltimore: Johns Hopkins University Press.

Prigatano, G.P., & Fordyce, D.J. (1986b). The neuropsychological rehabilitation program at Presbyterian Hospital, Oklahoma City. In G.P. Prigatano with D.J. Fordyce, H.K. Zeiner, J.R. Roueche, M.Pepping, & B.C. Wood. (Eds.), Neuropsychological rehabilitation after brain injury (pp. 96-118). Baltimore: Johns Hopkins University Press.

Prigatano, G.P., Fordyce, D.J., Zeiner, H.K., Roueche, J.R., Pepping, M., & Wood, C.B. (1986). The outcome of neuropsychological rehabilitation efforts. In G.P. Prigatano with D.J. Fordyce, H.K. Zeiner, J.R. Roueche, M.Pepping, & B.C. Wood. (Eds.), Neuropsychological rehabilitation after brain injury (pp. 119-133). Baltimore: Johns Hopkins University Press.

Ranseen, J.D., Bohaska, L.A., & Schmitt, F.A. (1990). An investigation of Anosognosia following traumatic head injury. International Journal of Clinical Neuropsychology, 7(1), 29-36.

Reed, B.R., Jagust, W.J., & Coulter, L. (1993). Anosognosia in Alzheimer's disease: Relationships to depression, cognitive function, and cerebral perfusion. Journal of Clinical and Experimental Neuropsychology, 15(2), 231-244.

Rosen, M. (1986). Denial and the head trauma client: A developmental formulation and treatment plan. Cognitive Rehabilitation, November/December, 20-22.

Sandifer, P.H. (1946). Anosognosia and disorders of the body scheme. Brain, 69, 122-137.

Schacter, D.L., & Prigatano, G.P. (1991). Forms of unawareness. In G.P. Prigatano, & D.L. Schacter (Eds). Awareness of deficit after brain injury. Clinical and theoretical issues (pp. 258-262). New York: Oxford University Press.

Shaw, R.E., Cohen, F., Doyle, B., & Palesky, J. (1985). The impact of denial and repressive style on information gain and rehabilitation outcomes in Myocardial Infarction patients. Psychosomatic Medicine, 47(3), 262-273.

Smith-Doody, R. (1993). A reappraisal of localization theory with reference to Aphasia. Part 1: Historical considerations. Brain and Language, 44, 296-326.

Stambrook, M., Moore, A.D., Kowalchuk, S., Peters, L.C., Kassum, D.A., McClarty, B.M., & Hawryluk, G.A. (1990). Early metabolic and neurological predictors of long-term quality of life following closed-head injury. Canadian Journal of Surgery, 33, 115-118.

Stambrook, M., Moore, A.D., Peters, L.C., Zubek, E., McBeath, S., & Friesen, I.C. (1991). Head injury and spinal cord injury: Differential effects on psychological functioning. Journal of Clinical and Experimental Neuropsychology, 13(4), 521-530.

Strauss, D.H., Spitzer, R.L., & Muskin, P.R. (1990). Maladaptive denial of physical illness: A proposal for DSM-IV. American Journal of Psychiatry, 147(9), 1168-1172.

Strickland, B.R. (1989). Internal-external control expectancies: From contingency to creativity. American Psychologist, 44, 1-12.

Stuss, D.T. (1987). Contribution of frontal lobe injury to cognitive impairment after closed head injury: methods of assessment and recent findings. In H.S. Levin, J. Grafman, & H.M. Eisenberg (Eds.), Neurobehavioural Recovery from Head Injury (pp. 166-177). New York: Oxford University Press.

Stuss, D.T. (1991). Disturbances of self-awareness after frontal system damage. In G.P. Prigatano & D.L. Schacter (Eds.), Awareness of deficit after brain injury: Clinical and theoretical issues (pp. 63-83). New York: Oxford University Press.

Stuss, D.T., & Benson, D.F. (1986). The Frontal lobes. New York: Raven Press.

Tulving, E. (1983). Elements of episodic memory. Oxford: Clarendon Press.

Watson, R.T., Valenstein, E., & Heilman, K.M. (1981). Thalamic neglect: Possible role of the medial thalamus and nucleus reticularis in behavior. Archives of Neurology, 38, 501-506.

Weinstein, E.A. (1991). Anosognosia and denial of illness. In G.P. Prigatano & D.L. Schacter (Eds.), Awareness of deficit after brain injury: Clinical and theoretical issues (pp. 240-257). New York: Oxford University Press.

Weinstein, E.A., & Kahn, R.L. (1955). Denial of illness. Springfield, IL: Charles C. Thomas Publishing Company.

Weinstein, E.A., & Lyerly, O.G. (1976). Personality factors in Jargon Aphasia. Cortex, 12, 122-133.

Weiskrantz, L., Warrington, E.K., Sanders, M.D., & Marshall, J. (1974). Visual capacity in the hemianopic field following restricted occipital ablation. Brain 97, 709-728.

Young, A.W., De Haan, E.H.F., & Newcombe, F. (1990). Unawareness of impaired face recognition. Brain and Cognition, 14, 1-18.

Youngjohn, J.R., & Altman, I.M. (1989). A performance-based group approach to the treatment of Anosognosia and denial. Rehabilitation Psychology, 34(3), 217-222.

Tables

Table 1

Inter-rater Reliability

Test Client Rated	Raters Compared (OTa X OTb)	Correlation Coefficient (r)	Degrees of Freedom (df)	Significance (p)
1	OT1 X OT2	0.62	29	<0.001
	OT1 X OT3	0.02	29	0.93
	OT2 X OT3	0.38	30	0.04
2	OT1 X OT2	0.72	24	<0.001
	OT1 X OT3	0.46	30	0.01
	OT2 X OT3	0.57	24	<0.01
3	OT1 X OT2	0.70	30	<0.001
	OT1 X OT3	0.69	30	<0.001
	OT2 X OT3	0.48	30	<0.01
4	OT1 X OT2	0.63	29	<0.001
	OT1 X OT3	0.73	29	<0.001
	OT2 X OT3	0.65	30	<0.001
Across test clients	OT1 X OT2	0.79	112	<0.001
	OT1 X OT3	0.80	118	<0.001
	OT2 X OT3	0.67	114	<0.001

Table 2

Mean Difference Scores on PCRS Concrete Items

Item Number and Content	Brain Injured	Non-brain Injured
1: Preparing own meals	0.88	-0.19
2: Dressing self	0.37	-0.53
3: Taking care of personal hygiene	0.41	-0.06
4: Washing the dishes	0.56	-0.29
5: Doing laundry	0.68	0.13
6: Taking care of finances	0.63	-0.53
7: Keeping appointments on time	0.00	-0.82
9: Staying involved in work activities even when bored or tired	0.00	-0.31
10: Remembering last night's dinner	-0.19	-1.06
11: Remembering the names of people seen often	-0.63	-0.59
12: Remembering daily schedule	0.13	-0.12
13: Remembering important things that must be done	-0.16	-0.12
14: Driving a car if necessary	1.06	0.44
22: Participating in group activities	-0.18	-0.62
24: Scheduling daily activities	0.60	-0.19
25: Understanding new instructions	0.42	-0.24

Table 3

Mean Difference Scores on PCRS Abstract Items

Item Number and Content	Brain Injured	Non-brain Injured
8: Staring a conversation in a group	-0.46	-1.13
15: Getting help when confused	0.66	0.00
16: Adjusting to unexpected changes	0.25	0.19
17: Handling arguments with people who are well known	0.48	-0.57
18: Accepting criticism	0.16	0.00
19: Controlling crying	-0.91	-0.94
20: Acting appropriately around friends	-0.19	-0.33
21: Showing affection to people	-0.10	-0.27
23: Recognizing having said or done something to upset someone else	0.19	0.12
26: Consistently meeting daily responsibilities	0.31	-0.35
27: Controlling temper when something upsetting occurs	-0.56	-0.35
28: Keeping from being depressed	-0.09	-0.24
29: Keeping emotions from affecting ability to carry out daily activities	-0.09	-0.47
30: Controlling laughter	-0.56	-0.82

Table 4

Mean Scale Scores on WOC-R (Raw and Relative)

Scale Name	Brain Injured		Non-brain Injured	
	Raw Score	Relative Score	Raw Score	Relative Score
Confrontive Coping (CC)	0.93	0.13	1.28	0.14
Distancing (D)	0.82	0.11	1.15	0.12
Self-Controlling (SC)	1.07	0.15	1.16	0.12
Seeking Social Support (SSS)	1.12	0.16	1.37	0.13
Accepting Responsibility (AR)	0.72	0.09	1.07	0.12
Escape-Avoidance (EA)	0.86	0.12	0.91	0.10
Planful Problem Solving (PPS)	0.87	0.12	1.39	0.14
Positive Reappraisal (PR)	0.80	0.11	1.11	0.10

Table 5

Mean Scores on PCRS Derived Scales

	Concrete Scale (D_C)	Abstract Scale (D_A)
Brain Injured	7.3	0.4
Non-Brain Injured	-3.7	-6.1

Table 6

Mean Scores on WOC-R Derived Scales

	Denial Scale (Den)	No Denial Scale (NDen)
Brain Injured	1.67	5.64
Non-Brain Injured	2.06	7.51

Figures

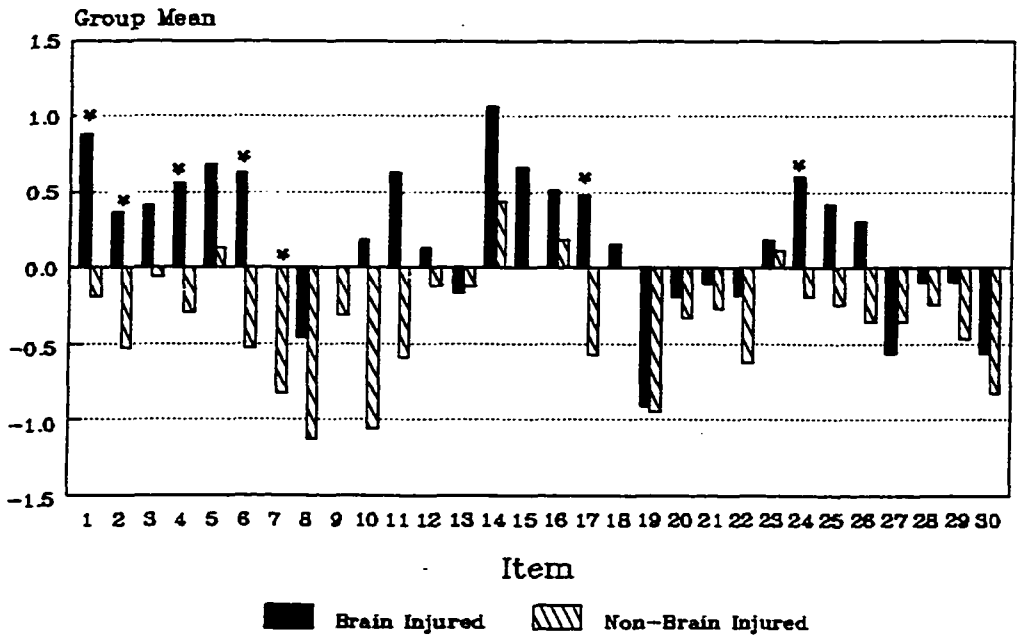


Figure 1. PCRS Item-by-Item Group Means

Please note that the symbol * identifies critical items.

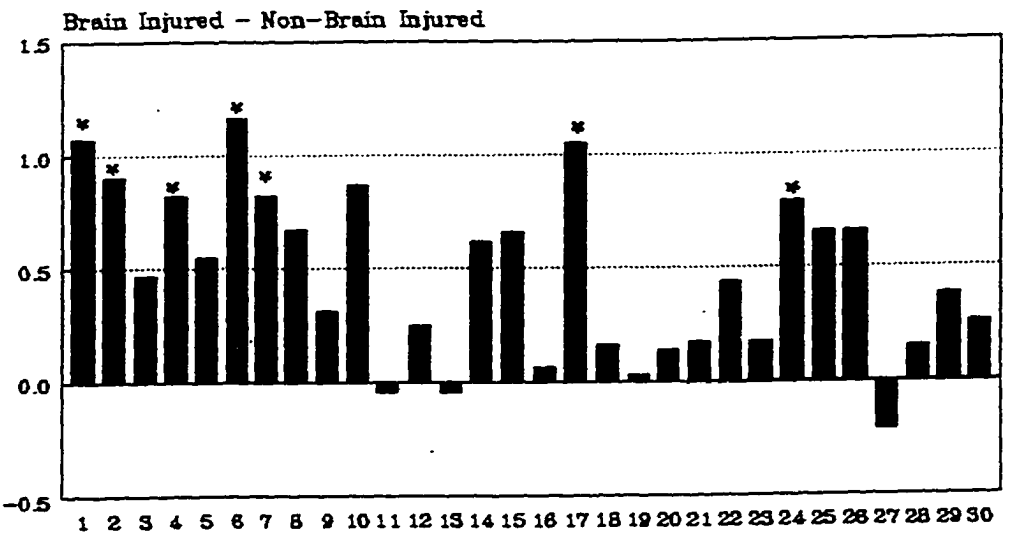


Figure 2. Group Differences in PCRS Item-by-Item Scores

Please note that the symbol * identifies critical items.

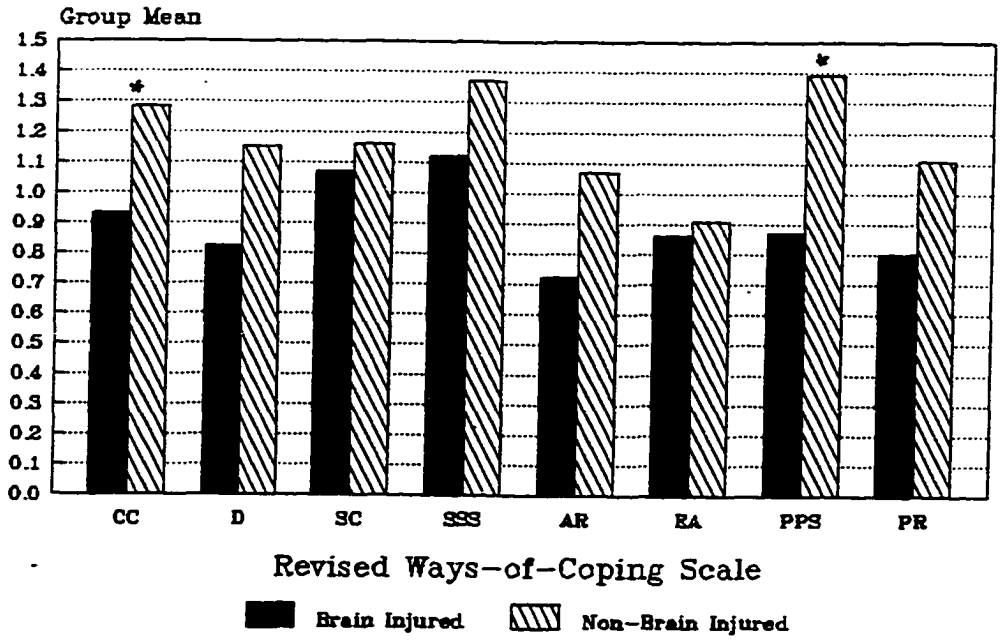


Figure 3. WOC-R Scale Group Means

Please note that the symbol * identifies statistically significant between-group differences in strategy use. The coping scale abbreviations may be interpreted as follows: CC: Confrontive Coping; D: Distancing; SC: Self-Controlling; SSS: Seeking Social Support; AR: Accepting Responsibility; EA: Escape Avoidance; PPS: Planful Problem Solving; PR: Positive Reappraisal.

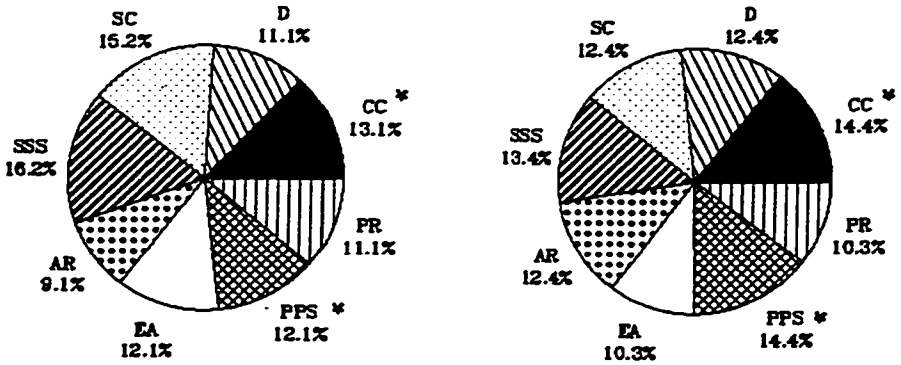


Figure 4. Relative Use of Coping Strategies in Both Groups

Please note that the symbol * identifies the coping scales for which raw scores differentiate significantly between the two groups. The coping scale abbreviations may be interpreted as follows: CC: Confrontive Coping; D: Distancing; SC: Self-Controlling; SSS: Seeking Social Support; AR: Accepting Responsibility; EA: Escape Avoidance; PPS: Planful Problem Solving; PR: Positive Reappraisal.

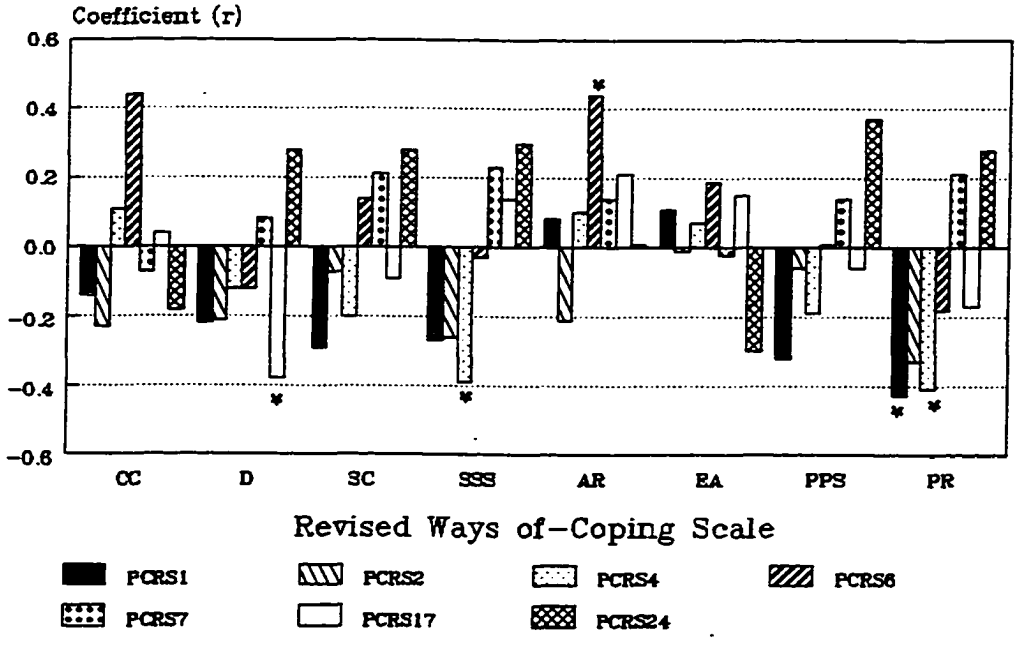


Figure 5. PCRS Critical Item and WOC-R Scale Correlations

Please note that the symbol * identifies significant correlations. The coping scale abbreviations may be interpreted as follows: CC: Confrontive Coping; D: Distancing; SC: Self-Controlling; SSS: Seeking Social Support; AR: Accepting Responsibility; EA: Escape Avoidance; PPS: Planful Problem Solving; PR: Positive Reappraisal.

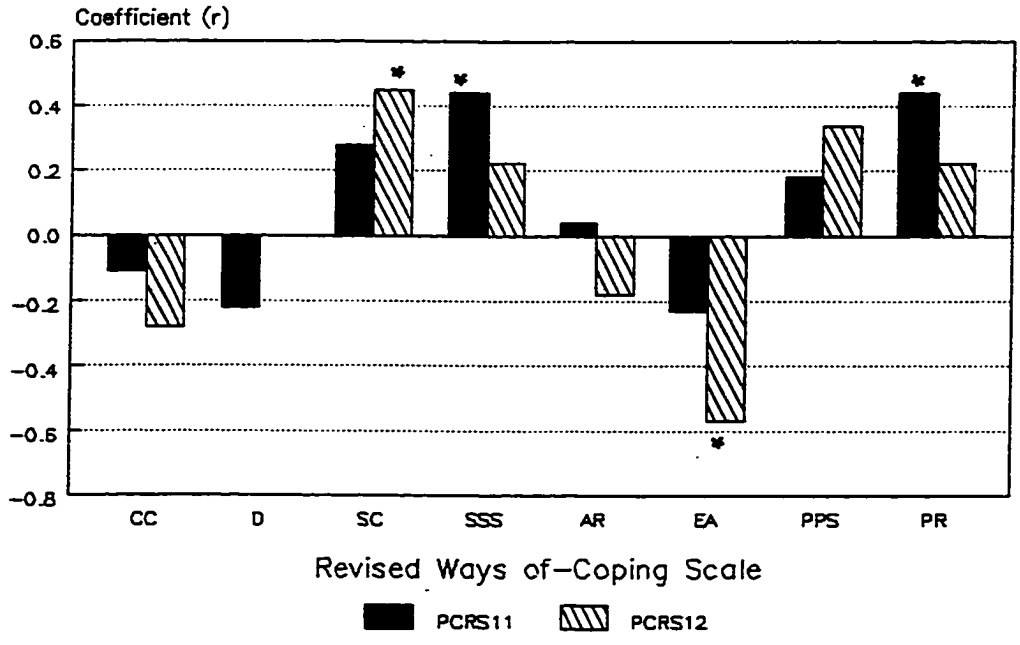


Figure 6. Correlations between PCRS non-critical Concrete items and WOC-R scales (Group means)

Please note that the symbol * identifies significant correlations. The coping scale abbreviations may be interpreted as follows: CC: Confrontive Coping; D: Distancing; SC: Self-Controlling; SSS: Seeking Social Support; AR: Accepting Responsibility; EA: Escape Avoidance; PPS: Planful Problem Solving; PR: Positive Reappraisal.

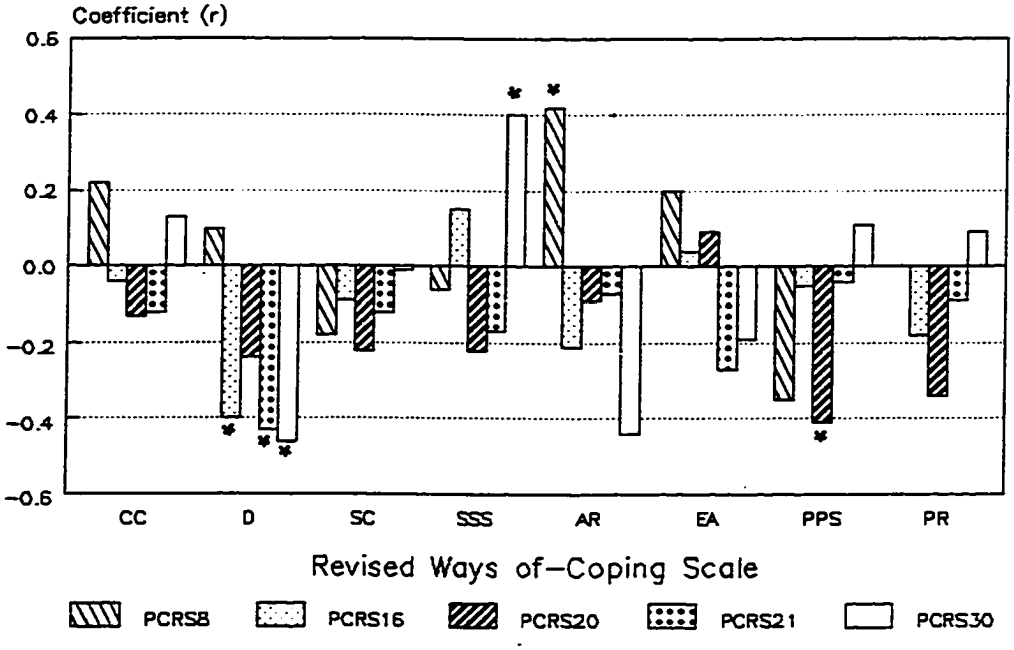


Figure 7. Correlations between PCRS non-critical Abstract items and WOC-R scales (Group means)

Please note that the symbol * identifies significant correlations. The coping scale abbreviations may be interpreted as follows: CC: Confrontive Coping; D: Distancing; SC: Self-Controlling; SSS: Seeking Social Support; AR: Accepting Responsibility; EA: Escape Avoidance; PPS: Planful Problem Solving; PR: Positive Reappraisal.

Appendices

Appendix A: Consent Form

Consent Form

I understand that Karen Wiseman, a graduate student in Psychology at Lakehead University is conducting a study for the Rehabilitation Unit at St. Joseph's Hospital. This study will investigate how aware rehabilitation patients are of their problems and how they cope with their problems. I understand that this study is part of the Rehabilitation Unit's evaluation of their program.

I understand that I will be asked to respond to a questionnaire that will take about 20 minutes. I understand that a member of my family or friend will also be asked to respond to a questionnaire.

I understand that I can refuse to take part in this study and that the rehabilitation treatment and services available from St. Joseph's Hospital will not be affected. I understand that I can withdraw from the study at any time.

I understand that the results will be treated as confidential medical information, and that no information with my name on it will leave the hospital.

I understand that I can receive the results of the study when it is completed, by contacting the Rehabilitation Unit.

_____ _____

Date Signature

Appendix B: Patient Competency Rating Survey--Client's Form

PATIENT COMPETENCY RATING
(PATIENT'S FORM)

Identifying Information

Patient's Name: _____

Patient's Age: _____

Date: _____

Instructions

The following is a questionnaire that asks you to judge your ability to do a variety of very practical skills. Some of the questions may not apply directly to things you often do, but you are asked to complete each question as if it were something you "had to do". On each question, you should judge how easy or difficult a particular activity is for you and mark the appropriate space.

Competency Rating

	Can't do	Very difficult to do	Can do with some difficulty	Fairly easy to do	Can do with ease
1. How much of a problem do I have in preparing my own meals?					
2. How much of a problem do I have in dressing myself?					
3. How much of a problem do I have in taking care of personal hygiene?					
4. How much of a problem do I have in washing the dishes?					
5. How much of a problem do I have in doing laundry?					
6. How much of a problem do I have in taking care of my finances?					

	Can't do	Very difficult to do	Can do with some difficulty	Fairly easy to do	Can do with ease
7. How much of a problem do I have in keeping appointments on time?					
8. How much of a problem do I have in starting conversation in a group?					
9. How much of a problem do I have in staying involved in work activities even when bored or tired?					
10. How much of a problem do I have in remembering what I had for dinner last night?					
11. How much of a problem do I have in remembering names of people I see often?					
12. How much of a problem do I have in remembering my daily schedule?					
13. How much of a problem do I have in remembering important things I must do?					
14. How much of a problem would I have driving a car if I had to?					
15. How much of a problem do I have in getting help when I'm confused?					
16. How much of a problem do I have in adjusting to unexpected changes?					

		Can't do	Very difficult to do	Can do with some difficulty	Fairly easy to do	Can do with ease
17.	How much of a problem do I have in handling arguments with people I know well?					
18.	How much of a problem do I have in accepting criticism from other people?					
19.	How much of a problem do I have in controlling crying?					
20.	How much of a problem do I have in acting appropriately when I'm around friends?					
21.	How much of a problem do I have in showing affection to people?					
22.	How much of a problem do I have in participating in group activities?					
23.	How much of a problem do I have in recognizing when something I say or do has upset someone else?					
24.	How much of a problem do I have in scheduling daily activities?					
25.	How much of a problem do I have in understanding new instructions?					

		Can't do	Very difficult to do	Can do with some difficulty	Fairly easy to do	Can do with ease
26.	How much of a problem do I have in consistently meeting my daily responsibilities?					
27.	How much of a problem do I have in controlling my temper when something upsets me?					
28.	How much of a problem do I have in keeping from being depressed?					
29.	How much of a problem do I have in keeping my emotions from affecting my ability to go about the day's activities?					
30.	How much of a problem do I have in controlling my laughter?					

mam\com-rate

Appendix C: Patient Competency Rating Survey--Staff Member's Form

PATIENT COMPETENCY RATING
(RELATIVE'S FORM)

Patient's Name: _____

Patient's Age: _____

Date: _____

Informant's relationship to patient (circle one):

1.	Mother	6.	Grandparent	11.	In-law
2.	Father	7.	Aunt or Uncle	12.	Ward attendant
3.	Spouse	8.	Niece or nephew	13.	Other O.T.
4.	Child	9.	Cousin		
5.	Sibling	10.	Friend		

Sex of Informant: Male _____
Female _____

How well is informant acquainted with patient's behaviour?

1.	Hardly at all	4.	Pretty well
2.	Not so well	5.	Very well
3.	Fairly well		

Instructions

The following is a questionnaire that asks you to judge this person's ability to do a variety of very practical skills. Some of the questions may not apply directly to things they often do, but you are asked to complete each question, you should judge how easy or difficult a particular activity is for them and mark the appropriate space.

Competency Rating

	Can't do	Very difficult to do	Can do with some difficulty	Fairly easy to do	Can do with ease
1. How much of a problem do they have in preparing their own meals?					
2. How much of a problem do they have in dressing themselves?					
3. How much of a problem do they have in taking care of their personal hygiene?					
4. How much of a problem do they have in washing the dishes?					
5. How much of a problem do they have in doing the laundry?					

	Can't do	Very difficult to do	Can do with some difficulty	Fairly easy to do	Can do with ease
6. How much of a problem do they have in taking care of their finances?					
7. How much of a problem do they have in keeping appointments on time?					
8. How much of a problem do they have in starting conversation in a group?					
9. How much of a problem do they have in staying involved in work activities even when bored or tired?					
10. How much of a problem do they have in remembering what they had for dinner last night?					
11. How much of a problem do they have in remembering names of people they see often?					
12. How much of a problem do they have in remembering their daily schedule?					
13. How much of a problem do they have in remembering important things they must do?					
14. How much of a problem would they have driving a car if they had to?					
15. How much of a problem do they have in getting help when they are confused?					
16. How much of a problem do they have in adjusting to unexpected changes?					
17. How much of a problem do they have in handling arguments with people they know well?					
18. How much of a problem do they have in accepting criticism from other people?					
19. How much of a problem do they have in controlling crying?					
20. How much of a problem do they have in acting appropriately when they are around friends?					
21. How much of a problem do they have in showing affection to people?					
22. How much of a problem do they have in participating in group activities?					
23. How much of a problem do they have in recognizing when something they say or do has upset someone else?					
24. How much of a problem do they have in scheduling daily activities?					

	Can't do	Very difficult to do	Can do with some difficulty	Fairly easy to do	Can do with ease
25. How much of a problem do they have in understanding new instructions?					
26. How much of a problem do they have in consistently meeting their daily responsibilities?					
27. How much of a problem do they have in controlling their temper when something upsets them?					
28. How much of a problem do they have in keeping from being depressed?					
29. How much of a problem do they have in keeping their emotions from affecting their ability to go about the day's activities?					
30. How much of a problem do they have in controlling their laughter?					

Appendix D: Revised Ways of Coping Questionnaire

"WAYS OF COPING" TEST

MIND GARDEN
Palo Alto, California

Please provide the following information:

Name:_____ Date:_____
Month / Day / Year

Identification Number (optional):_____ Gender (Circle): **M** **F** Age:____

Marital Status (check): ☐ Single ☐ Married ☐ Widowed ☐ Separate/Divorced

TO THE COUNSELOR

Fill out your Institutional Address below:

_____
Name/ Institution:

_____
Address

Instructions

To respond to the statements in this questionnaire, you must have a specific stressful situation in mind. Take a few moments and think about the most stressful situation that you have experienced in the *past week*.

By "stressful" we mean a situation that was difficult or troubling for you, either because you felt distressed about what happened, or because you had to use considerable effort to deal with the situation. The situation may have involved your family, your job, your friends, or something else important to you. Before responding to the statements, think about the details of this stressful situation, such as where it happened, who was involved, how you acted, and why it was important to you. While you may still be involved in the situation, or it could have already happened, it should be the most stressful situation that you experienced during the week.

As you respond to each of the statements, please keep this stressful situation in mind. **Read each statement carefully and indicate, by circling 0, 1, 2 or 3 , to what extent you used it in the situation.**

Key: **0** = Does not apply or not used **1** = Used somewhat
2 = Used quite a bit **3** = Used a great deal

Please try to respond to every question.

0 = Does not apply or not used 1 = Used somewhat 2 = Used quite a bit 3 = Used a great deal

1. I just concentrated on what I had to do next – the next step.	0	1	2	3
2. I tried to analyze the problem in order to understand it better.	0	1	2	3
3. I turned to work or another activity to take my mind off things.	0	1	2	3
4. I felt that time would have made a difference – the only thing was to wait.	0	1	2	3
5. I bargained or compromised to get something positive from the situation.	0	1	2	3
6. I did something that I didn't think would work, but at least I was doing something.	0	1	2	3
7. I tried to get the person responsible to change his or her mind.	0	1	2	3
8. I talked to someone to find out more about the situation.	0	1	2	3
9. I criticized or lectured myself.	0	1	2	3
10. I tried not to burn my bridges, but leave things open somewhat.	0	1	2	3
11. I hoped for a miracle.	0	1	2	3
12. I went along with fate; sometimes I just have bad luck.	0	1	2	3
13. I went on as if nothing had happened.	0	1	2	3
14. I tried to keep my feelings to myself.	0	1	2	3
15. I looked for the silver lining, so to speak; I tried to look on the bright side of things.	0	1	2	3
16. I slept more than usual.	0	1	2	3
17. I expressed anger to the person(s) who caused the problem.	0	1	2	3
18. I accepted sympathy and understanding from someone.	0	1	2	3
19. I told myself things that helped me feel better.	0	1	2	3
20. I was inspired to do something creative about the problem.	0	1	2	3
21. I tried to forget the whole thing.	0	1	2	3
22. I got professional help.	0	1	2	3

Go on to next page

0 = Does not apply or not used 1 = Used somewhat 2 = Used quite a bit 3 = Used a great deal

23. I changed or grew as a person.	0	1	2	3
24. I waited to see what would happen before doing anything.	0	1	2	3
25. I apologized or did something to make up.	0	1	2	3
26. I made a plan of action and followed it.	0	1	2	3
27. I accepted the next best thing to what I wanted.	0	1	2	3
28. I let my feelings out somehow.	0	1	2	3
29. I realized that I had brought the problem on myself.	0	1	2	3
30. I came out of the experience better than when I went in.	0	1	2	3
31. I talked to someone who could do something concrete about the problem.	0	1	2	3
32. I tried to get away from it for a while by resting or taking a vacation.	0	1	2	3
33. I tried to make myself feel better by eating, drinking, smoking, using drugs, or medications, etc.	0	1	2	3
34. I took a big chance or did something very risky to solve the problem.	0	1	2	3
35. I tried not to act too hastily or follow my first hunch.	0	1	2	3
36. I found new faith.	0	1	2	3
37. I maintained my pride and kept a stiff upper lip.	0	1	2	3
38. I rediscovered what is important in life.	0	1	2	3
39. I changed something so things would turn out all right.	0	1	2	3
40. I generally avoided being with people.	0	1	2	3
41. I didn't let it get to me; I refused to think too much about it.	0	1	2	3
42. I asked advice from a relative or friend I respected.	0	1	2	3
43. I kept others from knowing how bad things were.	0	1	2	3
44. I made light of the situation; I refused to get too serious about it.	0	1	2	3

Go on to next page

0 = Does not apply or not used 1 = Used somewhat 2 = Used quite a bit 3 = Used a great deal

45. I talked to someone about how I was feeling.	0	1	2	3
46. I stood my ground and fought for what I wanted.	0	1	2	3
47. I took it out on other people.	0	1	2	3
48. I drew on my past experiences; I was in a similar situation before.	0	1	2	3
49. I knew what had to be done, so I doubled my efforts to make things work.	0	1	2	3
50. I refused to believe that it had happened	0	1	2	3
51. I promised myself that things would be different next time.	0	1	2	3
52. I came up with a couple of different solutions to the problem.	0	1	2	3
53. I accepted the situation, since nothing could be done.	0	1	2	3
54. I tried to keep my feeling about the problem from interfering with other things.	0	1	2	3
55. I wished that I could change what had happened or how I felt.	0	1	2	3
56. I changed something about myself.	0	1	2	3
57. I daydreamed or imagined a better time or place than the one I was in.	0	1	2	3
58. I wished that the situation would go away or somehow be over with.	0	1	2	3
59. I had fantasies or wishes about how things might turn out.	0	1	2	3
60. I prayed.	0	1	2	3
61. I prepared myself for the worst.	0	1	2	3
62. I went over in my mind what I would say or do.	0	1	2	3
63. I thought about how a person I admire would handle this situation and used that as a model.	0	1	2	3
64 I tried to see things from the other person's point of view.	0	1	2	3
65. I reminded myself how much worse things could be.	0	1	2	3
66. I jogged or exercised.	0	1	2	3

Stop Here.

Description of the Coping Scales

Scale Name	**# of Items**	**Description** (Folkman and Lazarus, 1988)
Confrontive Coping	6	describes aggressive efforts to alter the situation and suggests some degree of hostility and risk-taking
Distancing*	6	describes cognitive efforts to detach oneself and to minimize the significance of the situation
Self-Controlling	7	describes efforts to regulate one's feelings and actions
Seeking Social Support	6	describes efforts to seek informational support, tangible support, and emotional support
Accepting Responsibility	4	acknowledges one's own role in the problem with a concomitant theme of trying to put things right
Escape-Avoidance*	8	describes wishful thinking and behavioural efforts to escape or avoid the problem
Planful Problem Solving	6	describes deliberate problem-focused efforts to alter the situation, coupled with an analytic approach to solving the problem
Positive Reappraisal	7	describes efforts to create positive meaning by focusing on personal growth (has a religious dimension)

* consistent with behaviours typical of denial

Appendix E: Data Collection Sheets

Data Collection Sheet--PCRS

Subject #:_____ Date:_____

Age:_____ Gender:_____

Impairment/Dx:_____ Date of Admission:_____

Marital Status:_____

Item #	Subject (S) Score	OT Score	S-OT (difference)
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____
4	_____	_____	_____
5	_____	_____	_____
6	_____	_____	_____
7	_____	_____	_____
8	_____	_____	_____
9	_____	_____	_____
10	_____	_____	_____
11	_____	_____	_____
12	_____	_____	_____
13	_____	_____	_____
14	_____	_____	_____
15	_____	_____	_____
16	_____	_____	_____
17	_____	_____	_____
18	_____	_____	_____

19	_____	_____	_____
20	_____	_____	_____
21	_____	_____	_____
22	_____	_____	_____
23	_____	_____	_____
24	_____	_____	_____
25	_____	_____	_____
26	_____	_____	_____
27	_____	_____	_____
28	_____	_____	_____
29	_____	_____	_____
30	_____	_____	_____
Σ	_____	_____	_____

Data Collection Sheet--WOC-R

Subject #:_____ Date:_____

Age:_____ Gender:_____

Impairment/Dx:_____ Date of Admission:_____

Marital Status:_____ Respondent's r/shp to Subject:_____

Item #	Score	Scales									
		CC		D		SC		SSS		AR	
		Item #	Score	Item #	Score	Item #	Score	Item #	Score	Item #	Score
1	-------	6	-------	12	-------	10	-------	8	-------	9	-------
2	-------	7	-------	13	-------	14	-------	18	-------	25	-------
3	-------	17	-------	15	-------	35	-------	22	-------	29	-------
4	-------	28	-------	21	-------	43	-------	31	-------	51	-------
5	-------	34	-------	41	-------	54	-------	42	-------	Σ	-------
6	-------	46	-------	44	-------	62	-------	45	-------		
7	-------	Σ	-------	Σ	-------	63	-------	Σ	-------		
8	-------					Σ	-------				
9	-------										
10	-------										
11	-------	EA		PPS		PR					
12	-------	Item #	Score	Item #	Score	Item #	Score				
13	-------	11	-------	1	-------	20	-------				
14	-------	16	-------	26	-------	23	-------				
15	-------	33	-------	39	-------	30	-------				
16	-------	40	-------	48	-------	36	-------				
17	-------	47	-------	49	-------	38	-------				
18	-------	50	-------	52	-------	56	-------				

19 ------- 58 ------- Σ ------- 60 -------
20 ------- 59 ------- Σ -------
21 ------- Σ -------
22 -------
23 -------
24 ------- Average Scores Relative Scores
25 ------- Scale Σ/# of items Scale Average Score/Σ_{av}
26 ------- CC ------- CC -------
27 ------- D ------- D -------
28 ------- SC ------- SC -------
29 ------- AR ------- AR -------
30 ------- SSS ------- SSS -------
31 ------- EA ------- EA -------
32 ------- PPS ------- PPS -------
33 ------- Σ_{av} -------
34 -------
35 -------
36 -------
37 -------
38 -------
39 -------
40 -------
41 -------
42 -------
43 -------
44 -------
45 -------
46 -------
47 -------
48 -------

49 _____

50 _____

51 _____

52 _____

53 _____

54 _____

55 _____

56 _____

57 _____

58 _____

59 _____

60 _____

61 _____

62 _____

63 _____

64 _____

65 _____

66 _____

Σ _____

Summary Data Sheet

Subject #:_____ Date:_____

Age:_____ Gender:_____

Impairment/Dx:_____ Date of Admission:_____

Marital Status:_____ WOC-R Respondent's r/shp to Subject:__

Test Scores

WOC-R:

Raw Score	CC:	D:	SC:	SSS:	AR:
Average Score	CC:	D:	SC:	SSS:	AR:
Relative Score	CC:	D:	SC:	SSS:	AR:
Raw Score	EA:	PPS:	PR:	Total:	
Average Score	EA:	PPS:	PR:	Total:	
Relative Score	EA:	PPS:	PR:		

PCR (Client's Form):

Concrete Scale:	Abstract Scale:	Total:

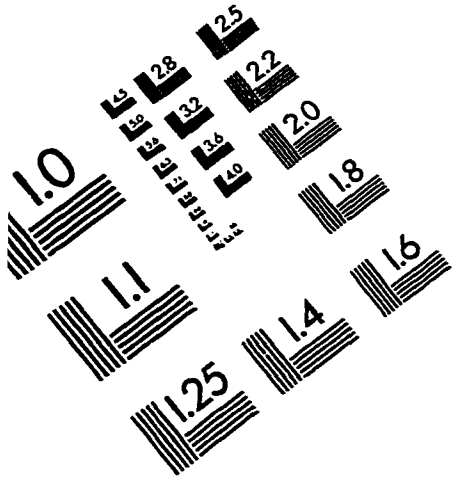
PCR (Staff Member's Form):

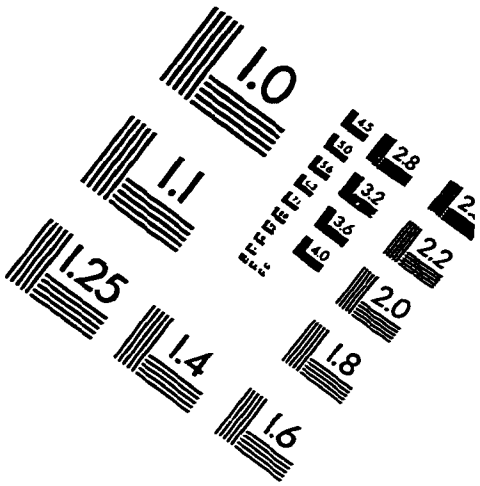
Concrete Scale:	Abstract Scale:	Total:

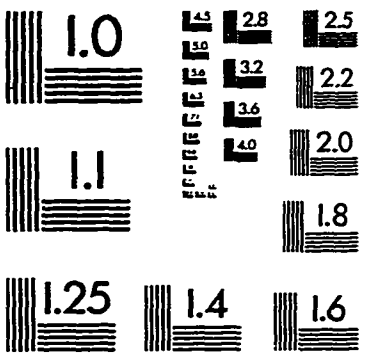
D Scores:

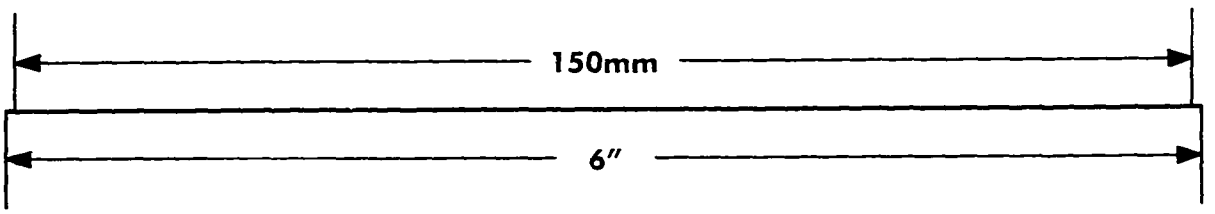
D_C:	D_A:	D_T:

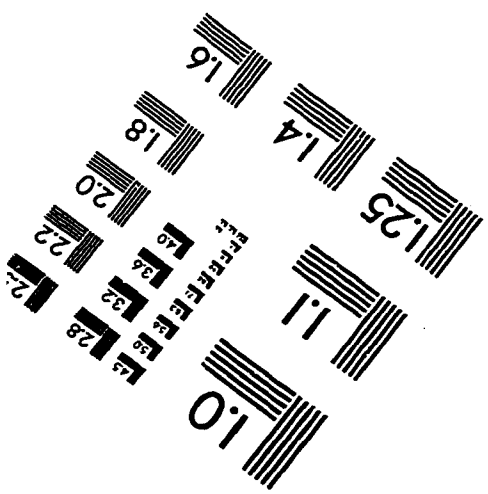
IMAGE EVALUATION TEST TARGET (QA-3)

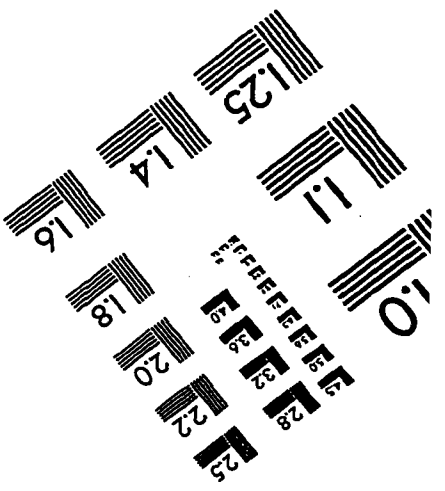












APPLIED IMAGE, Inc
1653 East Main Street
Rochester, NY 14609 USA
Phone: 716/482-0300
Fax: 716/288-5989