Correction Factors for the MMPI-2 in Head Injured Men and Women

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Abstract

The Minnesota Multiphasic Personality Inventory-2 (MMPI-2) is a personality test often used by psychologists to assess a person's emotional well being. In recent years it has been used to assess the level of psychological adjustment and distress in individuals following head injury (HI). There is concern that MMPI-2 profiles in that population have been artificially elevated by the endorsement of inventory items which not only represent personality traits and affect but also describe post-concussive symptoms. The interpretation of these profiles might, therefore, be distorted, potentially resulting in false predictions regarding rehabilitation potential and leading to the use of ineffective treatment strategies.

Correction factors for potential distortions of MMPI-2 profiles within HI populations have been developed. While beneficial these correction factors have not addressed issues other than brain concussion which may also have contributed to profile elevation. These include gender differences and the impact of chronic pain, often found in this population. This study evaluated MMPI-2 profiles of
100 men and 72 women following HI. No gender differences were found for any of the commonly used MMPI-2 scales. Both men and women showed elevations on MMPI-2 scales Hs, D, Hy, Pt, and Sc, supporting previous findings for HI populations. Item endorsement frequency was compared between each gender sample and two comparison groups: 1) the corresponding gender group from the normative sample of the MMPI-2, and 2) samples of men or women suffering chronic pain. Results indicate that for both gender groups MMPI-2 test scores are elevated by physical complaints associated with chronic pain and post-concussive symptoms. Two correction factors are suggested using items which were endorsed significantly differently by both head injured men and women. The first correction factor comprises 42 items describing common post concussive symptoms as well as complaints related to chronic pain. The second consists of 18 items likely more relevant to brain injury than chronic pain. Additional information is presented regarding MMPI-2 response patterns in the HI population as identified using cluster analysis.
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Dedication

To my parents who made it all possible.
Introduction

Motor vehicles are equipped with increasing numbers of life saving precautions such as anti-lock brakes, driver and passenger side air bags, fortified frame, head rests, and improved safety belts. These car improvements as well as a reported decline in the number of motor vehicle accidents (MVAs) between 1971 and 1986 (Statistics Canada, 1989) raise hope MVA related mortality rates will decline as well. But death is not the only consequence of MVAs. MVA related injuries burden our society with medical costs, rehabilitation expenses, and the loss of work days. In British Columbia alone the cost of claims related to MVAs in 1992 is estimated at $1.7 billion (Carter, 1994). Rising insurance costs suggest a growing expense and a need for careful allocation of resources. This responsibility lies in the hands of all of those involved in the care of MVA survivors, including neuropsychologists. Neuropsychologists are often involved in the assessment of head injury following MVAs and are asked to express their opinion regarding the prognosis and rehabilitation needs of the injured individual. Increased knowledge of head injury sequelae should result in better predictions of care and rehabilitation needs which hopefully will lead to the reduction of cost.
Head injury sequelae are multifaceted, including physical changes, such as damage to neurons, blood vessels, muscles and bones, and cognitive changes, such as impairments of memory, attention, and concentration. Debilitating as these changes may be clients and their families often find changes in emotional reaction and control most disturbing (Prigatano, 1986). Such changes are usually associated with overcoming trauma, grief over the loss of pre-morbid abilities, and the stress of adapting to a lower level of functioning. Knowledge of the typical emotional reactions following head injury could help professionals identify individuals who deviate from the norm and potentially require the allocation of additional resources (e.g. counseling, psychotherapy, home assistance, or support groups). The purpose of this study is to explore the emotional reactions of men and women following head injury.

A common sequela of head injury is the Post Traumatic Syndrome, or Post Concussional Syndrome (Lishman, 1987). The syndrome has not been clearly defined but usually includes the following symptoms: headache, dizziness, fatigue, noise and light sensitivity, irritability, emotional lability, memory problems, reduced concentration, and anxiety (World Health Organization, 1987). These symptoms are usually associated with physical damage such as cervical spinal strain, vestibular concussion, or shearing
of nerve fibers due to rotational forces incurred during acceleration-deceleration injuries (Lishman, 1987). Most post concussional symptoms are expected to disappear within a few weeks following injury (Barth, Alves, Ryan, Macciocchi, Rimel, Jane, and Nelson, 1989; Levin, 1989).

Speedy recovery from concussion may be common but it is not universal. In a fairly large percentage of individuals (between 15 and 34 percent) symptoms may last for months and even years (Rutherford, 1989). In cases of severe head injury with reported long periods of loss of consciousness (LOC) or post traumatic amnesia (PTA— the time from injury to the restoration of continuous recall) persistent headache, dizziness, and cognitive impairments are common and expected (Levin, Grossman, Rose, and Teasdale, 1979; Lishman, 1987). Unpredictably, in cases classed as mild head injuries (e.g. head impact with no LOC, reported brief LOC, or whiplash injury) chronic symptoms are more common than in cases of severe injury (Kay, Kerr, and Lassman, 1971). Often these symptoms have been attributed to an emotional over-reaction, possibly in hope of increasing financial or other secondary gain (Levy, 1992; Miller, 1961). However, recent findings indicate even mild head injuries may result in long term changes in brain metabolism and functioning (Ruff, Crouch, Troster, Marshall, Buchsbaum, Lottenberg, and Somers, 1994).
Although changes in cognitive functioning following head injury have been widely assessed and documented (e.g. Levin, Eisenberg, and Benton, 1989) the assessment of emotional changes has been limited. One reason for the discrepancy is the availability of a relatively large number of standardized tools currently used to quantify cognitive skills (Lezak, 1983; Spreen and Strauss, 1991). Cognitive skills such as intelligence, reading ability, or attention span can be measured and discussed in exact, statistical terms (e.g. "average", "above-average", or "in the tenth percentile compared to the general population"). Cognitive test scores can also be used in scientific research comparing the performance of different subject groups. Affect, on the other hand, is more often described in a qualitative and descriptive manner (e.g. "seemed depressed", "appeared agitated") with no quantitative criterion for comparison, thus making emotion a less suitable research variable.

The need for objective descriptions of personality traits, affect, and emotional well being was noted in the 1940's and led to the development of personality inventories. These inventories comprised statements describing personality traits, and individual preferences (Cattell and Eber, 1957; Edwards, 1959; Eysenck and Eysenck, 1963; Gough, 1948).
Personality inventories were often constructed asking a sample of "normal" individuals (a normative sample) to select from a variety of statements those which described them most accurately. These responses were then used as a baseline for comparison with patient populations. One of these inventories, the Minnesota Multiphasic Personality Inventory (MMPI), gained popularity and is currently the measure most commonly used by psychologists (Lubin, Larsen, Matarazzo, and Seever, 1985). This study explores the use of the MMPI and its successor--the MMPI-2--in assessing emotional sequelae of head injury.

The Minnesota Multiphasic Personality Inventory (MMPI)

The MMPI was published by Hathaway and McKinley (1940) in an attempt to facilitate diagnosis of psychiatric disorders. The inventory comprised 550 statements describing an individual's character and past experiences, self-endorsed as "True" or "False". Statements were then grouped into sets (clinical scales) presumed to differentiate between normal individuals and those diagnosed with one of eight psychiatric disorders (Hypochondriasis, Depression, Hysteria, Psychopathic Deviation, Paranoia, Psychasthenia, Schizophrenia, or Mania). In the following years several other sets of statements from the MMPI were associated with
specific traits and complaints such as Social Introversion, Alcoholism, Dominance, and Anxiety.

In its final form the MMPI comprised 566 statements yielding four "validity scales" and ten "clinical scales". Subsequent research and interpretation provided additional scales including twenty eight subscales (Harris-Lingoes subscales), fourteen "supplementary scales", and thirteen "content scales" (Wiggins scales; Graham, 1987). (See Appendix A for a detailed list and description of MMPI validity, clinical, and content scales. The description of additional scales is included in the description of MMPI-2 scales in Appendix B).

The MMPI was attractive to psychologists due to its empirical scientific approach and appearance. Scales were devised comparing groups of diagnosed psychiatric patients to normals. In order to diagnose psychopathology, scaled raw scores for normals were converted to linear T-scores with a mean of 50 and a standard deviation of 10. T-scores equal to or higher than 70 (two standard deviations) were considered "elevated", indicating specific pathology. T-scores could also be plotted as a "profile"- a pattern of scores which could be compared with typical profiles of specific psychotic or neurotic patient groups (Graham, 1977).
Another attractive feature of the MMPI was its intrinsic validity measures. The MMPI includes four validity scales (described in Appendix A) constructed to reflect deviant response patterns such as defensive responding, exaggerated response pattern, and profiles too distorted for valid interpretation.

During the first years of its use the MMPI proved unsuccessful as a tool diagnostic of psychiatric disorders (Graham, 1990). Nevertheless, the abundance of clinical data provided by MMPI scales was fertile ground for scientific research. The interpretation of the MMPI was modified using test profiles to describe personality traits rather than psychopathology. Scale elevations no longer implied the presence of specific psychiatric illnesses. Rather, they were considered in terms of the experiences and feelings commonly associated with the disease (Graham, 1990). For example, an elevated score on the schizophrenia scale no longer necessarily implied the client suffers from a disease that should be treated with anti-psychotic drugs. Instead, elevated scores could be interpreted to indicate confusion due to emotional turmoil with feelings of isolation, alienation, resentment, and dissatisfaction.

This change in the use of the MMPI allowed for the interpretation of test profiles of populations other than
psychiatric patients. It was recommended that in normal populations high scores be interpreted within the range of normal personality functioning (Lanyon, 1968).

Between 1948 and 1985 over ten thousand studies were conducted using the MMPI to assess personality in different populations (Graham, 1990). As research was not limited to psychiatric disorders attempts were made to find patterns, or response sets, typical of "non-psychiatric" clusters of individuals such as asthmatics (Jones, Kinsman, Schum, and Resnikoff, 1976), parents of learning disabled children (Dean and Jacobson, 1982), medical patients (Erickson and Freeman, 1976) and pregnant women (Hook and Marks, 1962). Of interest to this work is the body of research concerning individuals who have neurological problems.

**MMPI and neurological dysfunction**

A review of studies using the MMPI in neurologically dysfunctional populations shows the inventory had two major uses: (1) as a discriminating tool, separating brain damaged (BD) from non-brain damaged individuals, or (2) as an independent variable, describing unique groups of neurological patients (Mack, 1979).
Several attempts were made to use the MMPI to diagnose BD using specially formed scales. One such attempt, using a five item scale (Hovey, 1964) seemed promising and was somewhat successful at diagnosing multiple sclerosis patients (Hovey, 1967) and Parkinson's disease (Marsh, 1972). But when a mixed BD group was compared with a group of psychiatric patients classification accuracy diminished, and was considered too low for the diagnosis of individual patients (Upper and Seeman, 1968; Siskind, 1976).

Some success was achieved using the Sc-O (Schizophrenia-Organic) scale to differentiate schizophrenia and BD (Watson, 1971). The scale proved successful in male populations with either schizophrenia or BD, but was useless when applied to women or groups with a mixed diagnosis (Holland, Lowenfeld, and Wadsworth, 1975). Similar results were also found using the Organic Sign Index (OSI), a mathematical formula combining the raw scores of five of the clinical scales (Watson and Thomas, 1968).

Several other researchers attempted to find specific profiles, profile configurations, or cutoff scores that would discriminate psychiatric patients from BD (Gilberstadt and Duker, 1965; Russell, 1977; Watson, Plemel, and Jacobs, 1978). All of these attempts were only partially successful and with the development of neuropsychological tests it
became evident that testing the individual's cognitive abilities in combination with personality inventories provided a more accurate diagnosis than any MMPI criteria (Watson, 1973; Watson, Davis, and Gasser, 1978).

The quest for a scale discriminating BD from non-BD was not limited to psychiatric disorders. The Ps-N (Pseudo-Neurological) scale was developed in an attempt to differentiate neurological disorders from pseudo-neurological ones (Shaw and Matthews, 1965). This 17 item scale included statements from the Hypochondriasis (Hs) and Hysteria (Hy) scales showing significantly lower scores for patients with neurological disorders. The scale was relatively effective in distinguishing epileptics from pseudo-epileptics (Shaw, 1966) and multiple sclerosis from conversion hysteria (Dodge and Kolstoe, 1971). Scale efficacy was greatly diminished, however, when patients with a mixed diagnosis were considered (Pantano and Schwartz, 1978).

Overall, the MMPI was inefficient as a diagnostic tool for neurological disorders, often failing to classify BD correctly (Mack, 1979). Moreover, it appears that regardless of neuropathological deficit, patient groups show similar MMPI profiles. Individuals suffering from multiple sclerosis (Canter, 1951), myasthenia gravis (Schwartz and
Cahill, 1970), seizure disorder (Kløve and Doehring, 1962), Formaldehyde exposure (Cripe and Dodrill, 1988), low back pain (Sternbach, Wolf, Murphy, and Akeson, 1973a), and spinal cord injury (Kendall, Edinger, and Eberly, 1978) all showed similar elevations on the following MMPI clinical scales: Hypochondriasis (Hs), Depression (D), Hysteria (Hy), and Schizophrenia (Sc). Clinically, these elevated scores suggested patient groups experienced depressed mood, general anxiety, and concern over their somatic difficulties. Not surprisingly, MMPI profiles of individuals with brain injury provided similar results.

**MMPI and brain injury**

Most studies show that MMPI profiles of brain injured individuals are more likely to be elevated when compared to the normative sample, but not as elevated as MMPI profiles of psychiatric populations (Mack, 1979). Since MMPI profiles were not helpful in diagnosing BD, researchers turned to new areas of research concerning brain injury: (1) patient variables (e.g. age, sex, education) which may correlate with specific elevations on MMPI profiles, and (2) the clinical meaning of MMPI elevations in brain injured individuals (i.e. the emotional state suggested by the profile).
Following are some of the variables studied as predictors of MMPI profiles for brain injured individuals and suggested interpretations of the resulting profiles. The most extensively studied variables were injury localization, injury severity, time from injury, and gender.

**Injury site.**

The relationship between injury site and emotional reaction was noted by Goldstein (1948) who suggested that an injury to the left hemisphere (LHI) of the brain was usually followed by depression and anxiety. Goldstein (1952) observed that when faced with a task they cannot complete successfully, brain injured patients seem dazed and agitated, reacting in an unfriendly and even aggressive manner, much like a person in an extreme state of anxiety. The reason suggested for this behavior, which Goldstein named "catastrophic reaction" (1952), was cognitive confusion which reduces brain injured patients' ability to cope with anxiety or control its discharge. Brain injured individuals will, therefore, discharge their anxiety in an impulsive, sometimes inappropriate, manner. This behavior, in turn, is often met by punitive reactions from friends and family, leading to the patient's increased sense of confusion, helplessness, and depression (Goldstein, 1952).
A comparison of LHI and right hemisphere injury (RHI; Gainotti, 1972) found support for the association of LHI with an anxious, tearful and abusive reaction. RHI, by comparison, was associated with an indifferent response, a denial of injury and complaints (Gainotti, 1972).

Further research of the association between depressed mood and site of injury has been inconclusive. Some studies found a similar correlation between injury site and emotional reaction (Feibel and Springer, 1982), while others reported no relationship (Sinyor, Jacques, Kaloupek, Becker, Goldenberg, and Coopersmith, 1986), or even an opposite relationship, associating depressed mood with RHI (Folstein, Maiberger, and McHugh, 1977). A possible explanation for these conflicting results might be that a catastrophic reaction is the common response following brain injury regardless of type of lesion. Clinically, the reaction was considered an indicator of failure to cope with changes brought on by head injury, resulting in confusion, anxiety and depression (Prigatano, 1986).

Studies using the MMPI to assess patients with lateralized injuries were inconclusive as well. Several studies found more elevated scores, particularly on the Depression (D) scale, in patients with LHI (Louks, Calsyn, and Lindsay, 1976; Black, 1975; Gasparrini, Satz, Heilman, and Coolidge,
1978; Cullum and Bigler, 1987). An opposite finding was presented by Woodward, Bisbee, and Bennett (1984) who reported RHI patients had higher D scale scores than LHI. The majority of researchers, however, could not find a significantly different response pattern for LHI and RHI patients (Black and Black, 1982, Cullum and Bigler, 1988; Dikmen and Reitan, 1974; Gass and Ansley, 1994; Gass and Russell, 1986; Meier and French, 1965, Vogel, 1962). In most of these studies patients showed elevated scores on scale D and scale Sc consistent with the confused, anxious and depressed response to HI described by Goldstein (1952).

In summary, the relationship between injury site and MMPI response pattern has been inconsistent. Research has not been able to associate conclusively a specific MMPI profile with a specific injury localization. Regardless of injury site, patients tend to show elevated scores on scales D, and Sc suggesting a catastrophic reaction (confusion, anxiety and depression), possibly as a result of coping failure.

**Injury severity and time since injury.**

Injury severity can be measured using several indicators (e.g. length of LOC, PTA, or retrograde amnesia) and results may vary depending on the measure used. Despite
disagreements, most researchers have similar definitions of severity where HI is considered mild when LOC, PTA, or retrograde amnesia are non-existent or short in duration (very mild if lasting up to 10 minutes and mild if lasting longer than 10 minutes but less than an hour), while severe HI implies more than 24 hours of either or both LOC and PTA. When LOC or PTA last longer than an hour but less than a day, the injury is considered of moderate severity (Rimel, Giordani, Barth, Boll, and Jane, 1981; Levin, Mattis, Ruff, Eisenberg, Marshall, and Tabaddor, 1987).

Dikmen and Reitan (1977) found that compared to mildly injured patients, severely injured patients in a hospital setting were more likely to show elevations on scales Hs, D, Hy, Pt, and Sc of the MMPI. However, Novack, Daniel, and Long (1984) could not replicate these results in a sample of private clients, and in fact report opposite findings. Their study shows that mildly head injured individuals were more likely to show more elevated scores on scales Hs, D, and Hy than those with severe HI. The mild HI sample also reported more post concussive symptoms than severely head injured subjects. A similar finding was reported by Laininger, Kreutzer, and Hill (1991) who compared the MMPI profiles of individuals with minor and severe HI. The minor HI group showed significantly more elevated scores on MMPI scales Hs, Hy, and Pt.
None of the above studies controlled for time elapsed since injury, a variable that seems to contribute to MMPI scale elevations. A more recent study (Peck, Mitchell, Burke, Baber, and Schwartz, 1993) followed patients with mild, moderate or severe HI for a period of over two years. They found that within the first year following injury mildly injured individuals' MMPI profiles reflected more distress than those of the severely injured. Group differences did not last over time, however, and in less than two years following injury all patient groups reported similar patterns showing long-term distress. The authors suggested that the emerging similarity in distress pattern may be associated with an increase in distress among severely HI individuals as they become more aware of their difficulties. A comparison of a group of acute (less than 6 months since injury) and chronic (more than 6 months) severely HI individuals was consistent with this assumption. Fordyce, Roueche, and Prigatano (1983) found that patients with severe chronic HI showed higher MMPI elevations on validity scales F, and K, as well as on clinical scales D, Pd, Pt, Sc, and Si. The authors suggest these elevations in chronic HI indicate "generalized emotional distress" accompanied by social withdrawal.

In summary, though results are inconclusive, it appears that in the acute stage following HI those with mild HI may show
higher MMPI profile elevations than those with severe HI. These differences decrease over time and by six months following injury both mildly and severely HI individuals are equally likely to show MMPI profiles indicating much distress and social withdrawal.

**Gender and Brain Injury.**

Research of sex differences in cognitive skills of normal subjects show consistent differences between men and women. Women show greater verbal ability than men while men excel in visual-spatial skills and mathematical aptitude (Kolb and Whishaw, 1985; Lansdell, 1970, 1971; Maccoby and Jacklin, 1974). Finding neuro-anatomical differences between the sexes proved more difficult (Bryden, 1982). Initial research findings (McGlone, 1977, 1980) suggested men have more "lateralized brains", in which specific cognitive skills are associated with a particular hemisphere, while women tend to have less brain specificity (e.g., language skills are represented in both hemispheres rather than exclusively in the left hemisphere).

Based on this research it has been hypothesized that brain trauma affects men and women differently (Oddy, 1984). It was expected men would be more impaired by injury while
women would be able to utilize other brain areas to compensate for any damage. Studies provided some support for this notion (McGlone and Kertesz, 1973; Inglis and Lawson, 1981), showing that following lateralized brain injury men had specific cognitive deficits while women's results were mixed. This controversial finding inspired further studies which have been unable to replicate previous results. More recent research data shows no significant differences between cognitive skills of men and women following lateralized brain injury (Bornstein, 1984; Herring and Reitan, 1986; Kaufman, McLean, and Reynolds, 1990; Snow and Sheese, 1985; Whelan and Walker, 1988).

The difficulty in finding cognitive gender differences may reflect accurately the similarity between the sexes. An alternative explanation is that neurological and cognitive differences do exist but cannot be measured with standardized neuropsychological tests since many of them intentionally were constructed so that gender differences do not affect test results (e.g. the Wechsler Adult Intelligence Scale-Revised; Wechsler, 1981).

Even in the absence of neuro-anatomical and cognitive differences, men and women may have different reactions to brain trauma. Such differences, both emotional (Alfano, Neilson, Paniak, and Finlayson, 1992; Burton and Volpe,
1988) and somatic (Levin, Gary, High, Mattis, Ruff, Eisenberg, Marshall, and Tabaddor, 1987) were, in fact, reported and will be described in detail.

Levin et al. (1987) conducted a three-center study documenting post concussional symptoms reported by 155 individuals with mild HI. They found women tended to report many post-concussional symptoms suggesting cognitive impairment, depression and somatic symptoms (e.g. dizziness, visual disturbance). Men tended to report a minimal number of post-concussional symptoms or none at all.

Many statements describing symptoms seen in post concussion as well as in other medical and neurological conditions are included in the MMPI, especially in scales Hs, D, Hy and Sc (Cripe, 1991). If Levin et al. (1987) had used the MMPI their results could be expected to have produced higher elevations on these scales in women’s profiles. Since most existing research assessing MMPI profiles in HI utilized samples composed primarily, if not exclusively, of males, evaluating this hypothesis proved difficult.

Only two studies were found comparing MMPI profiles of men and women following HI. Alfano et al. (1992) compared MMPI profiles of men (N=77) and women (N=25) who did not differ significantly in regard to age, education, time from injury,
or marital status. Their MMPI profiles were significantly different but results only partially support Levin et al.'s findings. Contrary to expectation, Alfano et al. (1992) reported the Sc scale was the mean group high-point for men, not for women. The mean group high-point for women was the D scale, though this scale was slightly elevated in the men’s group as well. The Mania scale (Ma) was frequently elevated on men’s profiles, suggesting an overall reaction of mental confusion and reduced impulse control as previously seen in other studies. The Hysteria (Hy) and Paranoia (Pa) scales were more often elevated on women’s profiles, suggesting more somatically based concerns accompanied by depression. This last statement was the only finding consistent with Levin et al.’s study.

A second study yielded results showing more pronounced differences between men and women but not in the expected direction. Burton and Volpe (1988) tested smaller groups of men (N=25) and women (N=9) of similar age, intelligence, and time from injury. They reported six out of the ten MMPI clinical scales were significantly higher for men. Three of the clinical scales’ mean scores (scales D, Pd, and Sc) were elevated (T-score>70) in the men’s group while none of the mean scale scores were elevated for women. Their results suggest that in a chronic post HI population men, compared to women, show more emotional disturbance as measured with
In summary, the research in this area has been disappointingly scarce and to date failed to show consistent differences. While women tend to report more post-concussional symptoms than men, a comparison of their MMPI profiles suggests men show greater emotional disturbance than women. Women may endorse many statements describing somatic complaints and other post-concussive symptoms on the MMPI, however, it appears men endorse a higher proportion of all MMPI items resulting in generally more elevated scores.

**Interpretation of MMPI profiles in HI**

The clinical interpretation of MMPI scale elevations for individuals with HI was formed using the same guidelines as for other clinical populations. These guidelines suggest when scales Hs, D, and Hy are elevated the profile likely reflects anxiety and depressed mood associated with excessive somatic complaints ("neurotic triad", Skinner, 1979). When the Pt and Sc scales are also elevated ("general elevation", Sternbach, 1974) the interpretation often includes statements concerning general anxiety, confusion, psychological turmoil, and maladjustment (Graham, 1987).
There was growing dissatisfaction among clinicians regarding this interpretation of MMPI profiles for head injured individuals. Professionals began questioning whether MMPI elevations in this population indeed reflect emotional turmoil, generalized anxiety, and maladjustment as they would for a neurotic or psychiatric sample (Cripe, 1987). Rather, since several MMPI scales (particularly scales Hs, D, and Hy) contain statements describing post-concussional symptoms elevations may simply reflect the client's report of injury sequelae. Let us consider, for example, MMPI item no. 68: "I hardly ever feel pain in the back of my neck". Endorsement of this item, and other physical descriptions like it, by an otherwise healthy neurotic or psychotic patient may indicate increased tension, anxiety, fixation on somatic complaints, and even delusional thinking, all of which suggest heightened psychological turmoil. But what about HI survivors for whom neck pain is one of the most common symptoms? A "False" response in this case likely reflects actual pain related to neurological or physical damage rather than emotional distress (Grant and Alves, 1987; Cripe, 1991).

As a result, an MMPI scale which contains many such statements could easily reach significant elevation in patient populations. For example, five statements need to be endorsed on the F scale to elevate it from an average T-
score to a "pathological level". Six statements are required on the Hs scale and about seven statements will bring scales D and Hy from an average score to an elevated level (Butcher, Dahlstrom, Graham, Tellegen, and Kaemmer, 1989). Rather than reflecting distress, anxiety or concern, as such MMPI profiles are commonly interpreted, the elevations might indicate the existence of many physical symptoms experienced by the individual, relatively devoid of any emotional content. These elevations could be considered "artificial", an artifact of the physical condition of the responder, merely reflecting awareness of symptoms (Cripe, 1991). The common finding of elevated Hs, D, Hy, and Sc scales in other patient populations is consistent with this suggestion since these scales contain most of the statements pertaining to physical symptoms.

Concerns regarding artificial elevations on MMPI scales of neurological patients have been expressed by several clinicians (Chelune & Moehle, 1986; Lezak, 1983; Prigatano, 1987). Cautious interpretation of MMPI profiles in neurological populations was suggested to avoid stigmatization of individuals with psychological problems they may not be experiencing.

Specific, symptom related, items that may inflate MMPI scores were identified for particular patient groups such as
spinal cord injuries and multiple sclerosis (Kendall, Edinger, and Eberly, 1978; Mack, 1979). It was suggested that these identified item configurations could be removed from the profile as correction factors. The assumption was that the remaining scale elevations would then reflect the patient's emotional state unconfounded by the disease.

Alfano, Finlayson, Stearns, and Neilson (1990) tried to identify a similar correction factor for neurological disorders. The authors evaluated MMPI profiles of 66 men and 49 women diagnosed with a variety of neurological disorders (e.g. Cerebrovascular Disorder, Epilepsy, HI, and Alcoholic Dementia). As in previous studies they found frequent elevations on scales Hs, D, Hy, Pt, and Sc. With the help of eighteen neuroscientists 44 MMPI items were identified as "neurological items" (NC-44) and removed from all protocols. New MMPI profiles were plotted for the shortened version producing significant reductions in scale elevations, especially on scales Hs, D, Hy, Pt, Sc, and Ma.

**MMPI correction factors for HI**

Several authors attempted to identify MMPI correction factors specifically for HI patients. In these studies medical specialists in the clinical neurosciences were asked
to select appropriate items producing item lists of varying lengths (e.g. 13, 42, or 44 items) and different composition (Alfano, et al., 1990; Gass & Russell, 1991).

Alfano, Paniak, and Finlayson (1995) evaluated the use of their NC-44 (Alfano et al., 1990) in a sample of individuals with moderate to severe HI. The most common elevation for women (N=25) was on scales D and Hy while scales D and Sc were commonly elevated for men (N=77). Twenty-four items out of the 44 neurological items previously described were endorsed more frequently by subjects in this sample (at least 30% of the sample endorsed each item). These were chosen as the correction factor items for HI. Principal components analysis of this correction factor was used to identify two groups of items which the authors named "Neurobehavioral" (explaining 25% of the variance) and "Emotional/Somatic" (explaining 8.2% of the variance). The deletion of the 13 neurobehavioral items from each HI protocol produced mean MMPI profiles that showed no significant elevations. The greatest T-score reductions were noted on scales Sc (an average reduction of 9 and 8 T-scores for men and women, respectively) and D (an average reduction of 5 T-scores for men).

A possible difficulty with the removal of "neurological" items, as suggested by Alfano et al. (1990), is that the
resulting protocol may not have the same validity and generalizability as the original protocol. Gass and Russell (1991) suggested a different approach which might reduce that danger. The authors identified 42 items they considered neurologically related items (NRIs). Rather than deleting these items from subjects’ protocols they counted the number of Non-NRIs on each of the MMPI scales and added a prorated portion of NRIs to each scale. Thus, for example, if a subject endorsed many Non-NRIs on the depression scale a larger portion of NRIs from that scale would be added to the scale and the total raw score would be converted to T-scores. A smaller portion of NRIs would be added for a subject who endorsed only a few Non-NRIs on any of the scales.

Unfortunately, the idea of proportional inclusion of NRIs could not be satisfactorily tested in Gass and Russell’s study. Their sample was limited to 58 men who produced unusually low MMPI profiles with only one mean elevated score (scale D, T-score=70.8). Nevertheless, a comparison between the original and adjusted MMPI T-scores for their subject group showed significant differences on scales Hs, D, Hy, Pt, and Sc. Despite the different theoretical approach Gass and Russell’s technique seems to have produced results similar to those previously described by Alfano et al. (1990).
In summary, two approaches to the correction of MMPI protocols for neuro-behavioral symptoms were suggested. One approach proposed rescoring of each protocol following the removal of 13 items describing neuro-behavioral problems. The second approach recommended a more flexible technique which took into consideration the number of statements endorsed by each subject. Despite their limitations and differences both approaches produced similar results consistent with previous research findings, namely, neurological problems associated with HI are likely to create artificial elevations on scales Hs, D, Hy, Pt, and Sc.

Further research was suggested to evaluate the utility of each approach in larger samples, and to assess their utility in discriminating individuals with HI from other patient groups. But before any additional research can be described recent changes to the measuring tool itself should be considered.

The revised MMPI: MMPI-2

Because of its popularity and growing concerns regarding the application of 50 year-old norms to current populations it
was decided in the late 1980's that the MMPI should be restandardized and updated (Butcher et al., 1989; Graham, 1990). The changes included the use of a new normative sample, more broadly representative of the North American population; introduction of uniform T-scores, replacing the original linear T-scores; the addition of three validity scales; the elimination or rewording of about fifteen percent of the original MMPI items; and the lowering of the clinical cutoff score to one and a half standard deviations from the mean (T-score=65) rather than two standard deviations (Litz, Penk, Walsh, Hyer, Blake, Marx, Keane, and Bitman, 1991).

A detailed description of the changes is beyond the scope of this work (for more detailed reviews of the changes see Duckworth, 1991; Graham, 1990; and Levitt, 1990). Comparisons of the original and revised forms show both forms yield similar profiles and the changes have little effect on the interpretation of the main clinical scales (Ben-Porath and Butcher, 1989; Graham, Timbrook, and Ben-Porath, 1991; Litz et al., 1991; Tellegen and Ben-Porath, 1993). Although clinical scales remain relatively intact the elimination of items resulted in major changes to supplementary scales making it necessary to replace the MMPI's Wiggins scales with new Content Scales (see Appendix B for a description of the new content and additional
validity scales; Butcher, Graham, Williams, and Ben-Porath, 1990). To date limited research has been conducted to establish the utility of these scales in patient groups.

**Correction factors for the MMPI-2**

Following its revision the MMPI-2 was criticized because its use required clinicians to adapt to change and questions were raised regarding the application of MMPI research data to the revised inventory (Duckworth, 1991). The challenge was answered by an increasing number of studies using the MMPI-2, testing its usefulness in psychological work. The quest for a neuro-behavioral correction factor for the inventory continued as well.

Of the original NC-44 correction factor (Alfano et al., 1990) only 40 items survived the MMPI revision. In a follow up study Alfano et al. (1993) provided the MMPI-2 equivalent of their 24 "Closed Head Injury (CHI)" items (23 of which remain in the new version). They suggested, as with their original correction factor, scoring the MMPI-2 twice, once including the 13 "neurobehavioral" items and again following their deletion, to evaluate HI effects on MMPI-2 profiles.

This approach, which was supposed to increase the usefulness
of the MMPI-2 with HI patients, may have achieved just the opposite. Edwards, Morrison, and Weissman (1993) claimed psychologists were more reluctant to use the MMPI-2 for fear of being unable to interpret test results in a reliable way. The authors also contested the assumption that items suggested by Alfano et al. (1993) were unique to CHI. To test this hypothesis they compared the endorsement frequency for the 23 correction factor items in Alfano's CHI sample to a sample of psychiatric patients. Results showed only 5 items from the "neurobehavioral" factor and 4 items from the "emotional/somatic" factor were endorsed significantly more frequently by CHI patients (Edwards, Weissman, and Morrison, 1993). These items addressed speech problems (item 106), paralysis (item 295), inability to work (item 10), poor balance (item 179), weak manual control (item 177), tenderness at the top of the head (item 149), uncontrolled anger (item 37), memory problems (item 472), and unawareness of activities (item 168). Edwards and colleagues concluded most of Alfano's "neurobehavioral" items are not unique to CHI and may be endorsed by individuals with neurobehavioral problems associated with psychiatric illness. The authors proposed HI patients should be questioned regarding pre-morbid psychiatric problems which might be mistaken for HI related symptoms.
A different approach to neuro-behavioral correction of MMPI-2 profiles for HI patients was suggested by Gass (1991). The new, statistical approach to item selection compared the frequency of item endorsement by CHI patients to that of the MMPI-2 normative sample. This approach does not ask neuroscientists to make subjective judgements about each item but rather relies on a statistical comparison of endorsement frequency for each item. Items which discriminate between normals and HI patients are those with a significantly different endorsement frequency.

The statistical analysis produced 23 items which were endorsed significantly differently by CHI patients. A principal-components analysis was applied to these items resulting in two factors: (1) 14 items called "neurological complaints" (explaining 24.5% of the variance), and (2) 5 items named "psychiatric complaints" (explaining 3.7% of the variance). The 14 neurological complaints (9 of which appear in Alfano's 24 item correction factor) were offered as a correction factor for MMPI-2 protocols of individuals following CHI.

Gass's approach provides an objective way to produce a correction factor that takes into consideration baseline response rates in the normal population. Unfortunately, the resulting symptom list from Gass's study may be unreliable.
The control group used by Gass was the MMPI-2 adult male normative sample, even though the study sample comprised both sexes (70 men and 5 women). The study failed to consider previous findings of different MMPI profiles for men and women following head injury and the possibility that the inclusion of women's protocols may have altered the endorsement frequency measured for each item. A separate statistical analysis for each gender might have lead to the formation of a separate correction factor for men and women.

Another issue was raised by Edwards, Weissman, and Morrison (1993). In their second study the authors compared the endorsement frequency of Gass's neurological items by CHI patients to a sample of psychiatric patients. They found, much as they did for Alfano's "neurobehavioral" items, that only 6 of the 14 items were endorsed significantly more frequently by individuals with CHI. Three of these items, dealing with balance, paralysis and speech, appear on Alfano's list as well (items 106, 179, and 295). The other three items describe reading difficulties (item 147), memory problems (item 165), and hand tremors (item 172). While Gass's list is capable of discriminating HI from normals these findings indicate that any central nervous system (CNS) damage inferred from the list might be associated with psychiatric problems as well as HI.
This review has suggested many neurological disorders result in similar elevations on the MMPI (commonly scales Hs, D, Hy, Pt, and Sc). Could it be that either or both Alfano and Gass identified items unique to central nervous system (CNS) disturbance? Moreover, would the elimination of either item list from the MMPI-2 profile result in a pattern which accurately describes the emotions of an individual following HI?

**Chronic pain and the MMPI-2**

The answer to the question regarding CNS items may be found by comparing MMPI-2 protocols of individuals with HI to those of individuals complaining of chronic pain (CP). Chronic pain is common following HI (Uomoto and Esselman, 1993) but not as a result of CNS damage. Typically in such cases, CP is associated with musculo-ligamentous strain, fractures, and accelerated arthritic degeneration due to injury (Horn and Garland, 1990). Following are some relevant MMPI findings regarding CP. For a more thorough review of MMPI research with chronic pain see Keller and Butcher (1991).

It is interesting to note that MMPI research in CP parallels findings in HI. Similar to its use in the study of HI, the
MMPI was used to describe the average pain patient, to
distinguish between organic pain and pain believed to be
functional in nature, and to predict treatment outcome
After several attempts were made to find a scale or cluster
of items that could discriminate organic from functional CP
the MMPI was deemed useless for that purpose (Sternbach,
Wolf, Murphy, and Akeson, 1973a, 1973b). The inventory
showed more promise as a predictor of long-term treatment
outcome in CP patients (Strassberg et al., 1981; Kleinke,
1994).

Another similarity with HI research was the suggestion that
MMPI profiles of CP patients were artificially elevated
 especially scales Hs, D, and Hy) due to the endorsement of
disease related items (Pincus, Callahan, Bradley, Vaughn,
and Wolf, 1986). In fact, MMPI correction factors for CP
preceded the creation of correction factors for HI noted
above and laid the theoretical basis for their construction
(Taylor, 1970). One of these correction factors (Kendall,
Edinger, and Eberly, 1978) comprised 10 items selected by
comparing endorsement frequencies of spinal-cord injury
patients and two control groups. A comparison of the 10
items with the two HI-correction factors (Alfano et al.,
1990; Gass, 1991) shows three of these items are included in
Gass’s correction factor and six items appear in Alfano et
The similarities between correction factors for HI and CP patients suggest the so-called "neurobehavioral-correction factors" might include somatic complaints other than CNS related symptoms. Additionally, many of the emotional reactions found following HI (i.e. depression, irritability, anxiety, and reduced concentration) may actually be the result of chronic pain rather than brain damage (Uomoto and Esselman, 1993). If correct, these suggestions may indicate a need to combine future CP and HI research to predict outcome and select treatment plans more efficiently. For example, a potential recommendation might be to direct more rehabilitation efforts at alleviating pain rather than improving memory. Combined data might also help find the exceptions to the norm, i.e. those individuals who require more support than others and, on the other hand, those who exaggerate their symptoms either knowingly or subconsciously.

Recently, Keller and Butcher (1991) conducted a study comparing MMPI-2 profiles of a CP sample (268 men and 234 women) to the normative sample of the MMPI-2 and to a psychiatric sample (collected as part of the MMPI-2 restandardization project). Their results were similar to those found using the MMPI indicating the MMPI-2 was as
valid as the MMPI in evaluating CP. Compared to the normative sample, CP patients showed elevated scale scores on clinical scales Hs, D, and Hy, and on the Health Concerns content scale (HEA). The psychiatric sample scores showed more anxiety and general psychological turmoil than the CP sample (scales F, D, Pd, Pa, Pt, and Sc were elevated). Nevertheless, CP scale scores were higher where physical health was concerned (scales Hs and Hy).

Keller and Butcher (1991) did not compare their results to those of individuals with HI. However, their results provide another piece of information in the quest for a neurobehavioral correction factor. Research to date suggests MMPI-2 profiles of HI and psychiatric patients do not differ significantly on the existing correction factors, possibly because both groups exhibit some form of CNS damage (Edwards, Weissman, and Morrison, 1993). CP research indicates psychiatric and CP patients' MMPI-2 scores differ on scales pertaining to somatic concerns. A possible reason for the difference in the comparison of HI and CP with psychiatric patients could be that items endorsed differently by CP patients reflect their specific non-CNS complaints. It could be hypothesized, therefore, that any difference between MMPI-2 protocols of HI and CP samples will result in a list of CNS related complaints which could be used as a correction factor for HI individuals.
Hypotheses

A. Based on the literature it is expected that men and women would have different MMPI-2 profiles following HI. The first stage of this study will explore gender response differences on all MMPI-2 scales including the main clinical scales, Harris-Lingoes subscales, content scales, and supplementary scales.

B. It is hypothesized that MMPI-2 correction factors for men and women with HI can be constructed using a separate statistical analysis in each HI gender group, comparing HI item endorsement frequency to that of the respective normative sample. While reflecting gender differences, results are expected to yield item lists similar to those identified by Gass (1993) with most items contributing to the elevation of scales Hs, D, Hy, Pt, and Sc.

C. It is hypothesized that items pertaining to CNS symptoms related to brain damage can be identified on MMPI-2 protocols of individuals with HI when compared to those of CP patients.
The statistical method of endorsement frequency comparison appears to be an efficient strategy for finding MMPI items unique to a specific group (Gass, 1991; Kendall et al., 1978). Although Keller and Butcher (1993) reported endorsement frequencies for all items in their CP sample they have not published the statistical analyses of these results to date.

Item endorsement frequency for those items identified in hypothesis B, will be compared with endorsement frequency for Keller and Butcher's CP sample to identify items unique to HI. Since HI is associated with elevations on scales Hs, D, Hy, Pt, and Sc while CP is associated only with elevations on the first three scales, it is expected that items unique to HI, compared to a CP sample, will contribute to the elevation of scales Pt and Sc more than other scales.
Method

Subjects

1. Head Injury sample (HI)

MMPI-2 protocols of 100 males (MHI) and 72 females (FHI), assessed between 1989 and 1993 following head injury, were included in this sample. All subjects were tested as part of a neuropsychological assessment prior to the settlement of insurance claims for personal injuries.

A. Selection criteria.
One hundred and ninety-two protocols of men and women who were tested at least six months post injury were examined. Twenty cases (about 10%) were excluded based on the following selection criteria.

1. Cause of injury. Only individuals with HI as a result of a motor vehicle accident were included. The presence of any of the following resulted in exclusion from the study: 1) a neurological disorder (suspected or diagnosed) not associated with head injury (e.g. Parkinson’s Disease, Multiple Sclerosis), 2) history of a pre-injury psychiatric
disorder, or 3) history of drug or alcohol abuse requiring detoxification. Eight subjects were excluded based on these criteria.

2. A valid MMPI-2 Profile. Only individuals with valid MMPI-2 profiles were included in the study. Invalid profiles were identified using any of the following criteria: 1) more than 30 unanswered items, 2) F scale raw score above 18 (T-score=92 for men and 99 for women), 3) F minus K raw scores above 12 for women and above 17 for men, or 4) Fb scale raw score above 22 for women and above 19 for men (Graham, Watts, and Timbrook, 1991). Seven subjects were excluded based on these criteria.

3. Reading level. The reading level necessary for accurate comprehension and response on the MMPI-2 was estimated at grade six level (Paolo, Ryan, and Smith, 1991; Pope, Butcher, and Seelen, 1993). All subjects had at least grade six level reading, assessed using the Stanford Diagnostic Reading Test (Karlsen and Gardner, 1986). Five subjects were excluded based on this criterion.
B. Descriptive statistics of sample.

1. Age. All subjects were at least 18 years old at the time of assessment (Butcher et al., 1989). Subjects’ ages at the time of assessment ranged from 18 to 74 for males (Mean: 34 years 4 months, standard deviation: 13 years 1 month) and from 18 to 71 for females (Mean: 34 years 6 months, standard deviation: 13 years 6 months). Table 1 presents the distribution of ages in the male and female samples.

<table>
<thead>
<tr>
<th>Age group</th>
<th>MU (N, percent)</th>
<th>FHI (N, percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 - 19</td>
<td>10 (10.0%)</td>
<td>8 (11.1%)</td>
</tr>
<tr>
<td>20 - 29</td>
<td>37 (37.0%)</td>
<td>23 (31.9%)</td>
</tr>
<tr>
<td>30 - 39</td>
<td>23 (23.0%)</td>
<td>20 (27.8%)</td>
</tr>
<tr>
<td>40 - 49</td>
<td>19 (19.0%)</td>
<td>11 (15.3%)</td>
</tr>
<tr>
<td>50 - 59</td>
<td>6 (6.0%)</td>
<td>4 (5.6%)</td>
</tr>
<tr>
<td>60 - 69</td>
<td>3 (3.0%)</td>
<td>5 (6.9%)</td>
</tr>
<tr>
<td>70 - 79</td>
<td>2 (2.0%)</td>
<td>1 (1.4%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100 (100.0%)</td>
<td>72 (100.0%)</td>
</tr>
</tbody>
</table>

Note. No significant difference in age distribution (ANOVA: F=0.005, p=.95).

2. Sex. The HI sample comprised 72 women (41.9%) and 100 men (58.1%). The literature reviewed indicated a ratio of 2-3 males to 1 female among individuals with traumatic brain injuries. There is no clear explanation for the greater proportion of women in this sample.
3. Education and intelligence. Subjects' education level at the time of assessment ranged from 7 years to 20 years for men (Mean: 12 years 1 month, standard deviation: 2 years 6 months) and from 5 years to 19 years for women (Mean: 12 years 5 months, standard deviation: 2 years 4 months). Table 2 presents the distribution of years of education in the male and female samples.

Table 2

<table>
<thead>
<tr>
<th>Education level</th>
<th>MHI</th>
<th>FHI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>percent</td>
</tr>
<tr>
<td>Part High-School</td>
<td>40</td>
<td>40.0%</td>
</tr>
<tr>
<td>High-School Grad.</td>
<td>29</td>
<td>29.0%</td>
</tr>
<tr>
<td>College Grad.</td>
<td>21</td>
<td>21.0%</td>
</tr>
<tr>
<td>Post Graduate educ.</td>
<td>10</td>
<td>10.0%</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Note. No significant difference in education distribution (ANOVA: F=0.822, p=0.37).

A recent census of B.C. residents (Statistics Canada, 1994) showed a similar distribution of education levels in the province. Figures were not available for each gender separately but the combined numbers indicated 34% of B.C. residents have part high-school education, 25% graduated high-school, about 30% hold the equivalent of a college degree, and about 11% have post graduate education.
Measured IQ (using either the Wechsler Adult Intelligence Scale-Revised or the Stanford-Binet Intelligence Test) ranged from 75 to 134 for men (Mean: 100.36, standard deviation: 12.36) and from 80 to 131 for women (Mean: 98.57, standard deviation: 10.71). No significant differences were found between men and women for Verbal IQ, Performance IQ, and Full Scale (composite) IQ as presented in Table 3.

<table>
<thead>
<tr>
<th></th>
<th>MHI Mean (Sd)</th>
<th>PHI Mean (SD)</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal IQ</td>
<td>100.11 (12.52)</td>
<td>97.50 (12.02)</td>
<td>1.881</td>
<td>.17</td>
</tr>
<tr>
<td>Performance IQ</td>
<td>100.87 (13.49)</td>
<td>101.54 (12.54)</td>
<td>0.111</td>
<td>.74</td>
</tr>
<tr>
<td>Full Scale IQ</td>
<td>100.36 (12.63)</td>
<td>98.57 (10.71)</td>
<td>0.953</td>
<td>.33</td>
</tr>
</tbody>
</table>

4. Marital status. Data concerning subjects' marital status are presented in Table 4. Most subjects, both men and women, were single or married. A higher proportion of women were divorced or widowed.
### Table 4
Marital status of men and women with HI

<table>
<thead>
<tr>
<th>Marital status</th>
<th>MHI N</th>
<th>MHI percent</th>
<th>FHI N</th>
<th>FHI percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>45</td>
<td>45.0%</td>
<td>27</td>
<td>37.5%</td>
</tr>
<tr>
<td>Married</td>
<td>36</td>
<td>36.0%</td>
<td>28</td>
<td>38.8%</td>
</tr>
<tr>
<td>Separated</td>
<td>5</td>
<td>5.0%</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Divorced</td>
<td>9</td>
<td>9.0%</td>
<td>9</td>
<td>12.5%</td>
</tr>
<tr>
<td>Common Law</td>
<td>5</td>
<td>5.0%</td>
<td>5</td>
<td>7.0%</td>
</tr>
<tr>
<td>Widow</td>
<td>0</td>
<td>0.0%</td>
<td>3</td>
<td>4.2%</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100.0%</td>
<td>72</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

A recent census of the Canadian population (Statistics Canada, 1992) showed a similar proportion of single individuals (45% of men and 39% of women), as well as married or common-law relationships (49% of men and 47% of women). The HI sample had a higher proportion of divorced individuals (versus 2.6% and 4% of Canadian men and women, respectively) and a higher number of separated men (compared to 1.6% of the national sample). The HI group also included fewer widowed women (compared to 8% of Canadian women).

5. Race. Data concerning subjects’ race are presented in Table 5. The sample’s racial distribution does not represent either Canadian or B.C. populations since Caucasians comprise over 95 percent of the sample. A recent census of Canadian residents (Statistics Canada, 1994) indicates Caucasians represent only about 52% of the total population of Canada and about 35% of B.C. residents. The
discrepancy may reflect a reluctance to pursue litigation on the part of individuals from minority groups, or limited awareness of the right to seek compensation following HI.

Table 5
Race distribution for men and women with HI

<table>
<thead>
<tr>
<th>Race</th>
<th>MHI N</th>
<th>MHI percent</th>
<th>FHI N</th>
<th>FHI percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>98</td>
<td>98.0%</td>
<td>69</td>
<td>95.8%</td>
</tr>
<tr>
<td>Asian</td>
<td>2</td>
<td>2.0%</td>
<td>2</td>
<td>2.8%</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0.0%</td>
<td>1</td>
<td>1.4%</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100.0%</td>
<td>72</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

6. Occupational status. Data concerning subjects' occupations are presented in Table 6. The classification was made according to criteria cited by Barona, Reynolds, and Chastain (1984) and Wechsler (1981). A higher proportion of men in the sample held semi-skilled and skilled work positions while a higher proportion of the women held skilled white collar positions.

Table 6
Occupational status for men and women with HI

<table>
<thead>
<tr>
<th>Occupation</th>
<th>MHI N</th>
<th>MHI percent</th>
<th>FHI N</th>
<th>FHI percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unskilled worker</td>
<td>10</td>
<td>10.0%</td>
<td>11</td>
<td>15.3%</td>
</tr>
<tr>
<td>Semi-skilled worker</td>
<td>25</td>
<td>25.0%</td>
<td>14</td>
<td>19.5%</td>
</tr>
<tr>
<td>Student</td>
<td>15</td>
<td>15.0%</td>
<td>8</td>
<td>11.1%</td>
</tr>
<tr>
<td>Not in the work force</td>
<td>11</td>
<td>11.0%</td>
<td>12</td>
<td>16.6%</td>
</tr>
<tr>
<td>Skilled worker</td>
<td>19</td>
<td>19.0%</td>
<td>4</td>
<td>5.6%</td>
</tr>
<tr>
<td>Skilled White Collar</td>
<td>14</td>
<td>14.0%</td>
<td>16</td>
<td>22.2%</td>
</tr>
<tr>
<td>Professional</td>
<td>6</td>
<td>6.0%</td>
<td>7</td>
<td>9.7%</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100.0%</td>
<td>72</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
7. Injury data. Injury severity can be represented by length of loss of consciousness (LOC) and length of post traumatic amnesia (PTA). Table 7 presents data regarding LOC for MHI and FHI.

Table 7
Length of LOC for men and women with HI

<table>
<thead>
<tr>
<th></th>
<th>MHI</th>
<th>FHI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>percent</td>
</tr>
<tr>
<td>Nil</td>
<td>33</td>
<td>33.0%</td>
</tr>
<tr>
<td>Less than 1 hr.</td>
<td>43</td>
<td>43.0%</td>
</tr>
<tr>
<td>1-24 hours</td>
<td>8</td>
<td>8.0%</td>
</tr>
<tr>
<td>1-7 days</td>
<td>9</td>
<td>9.0%</td>
</tr>
<tr>
<td>More than 7 days</td>
<td>7</td>
<td>7.0%</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Note. No significant differences were found between LOC length of men and women (Chi Square=.223; p=.07).

Table 8 presents data regarding PTA for MHI and FHI.

Table 8
Length of PTA for men and women with HI

<table>
<thead>
<tr>
<th></th>
<th>MHI</th>
<th>FHI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>percent</td>
</tr>
<tr>
<td>Nil</td>
<td>29</td>
<td>29.0%</td>
</tr>
<tr>
<td>Less than 1 hr.</td>
<td>27</td>
<td>27.0%</td>
</tr>
<tr>
<td>1-24 hours</td>
<td>16</td>
<td>16.0%</td>
</tr>
<tr>
<td>1-7 days</td>
<td>10</td>
<td>10.0%</td>
</tr>
<tr>
<td>More than 7 days</td>
<td>18</td>
<td>18.0%</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Note. No significant differences were found between PTA length of men and women (Chi Square=.185; p=.21).
Table 9 presents subjects' ages at the time of their injury. The median injury age for MHI was 30 years 8 months (range 14 to 73 years). The median injury age for FHI was 31 years 5 months (range 14 to 71 years).

Table 9
Age at injury for men and women in the HI group

<table>
<thead>
<tr>
<th>Age group</th>
<th>MHI</th>
<th>FHI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>percent</td>
</tr>
<tr>
<td>Less than 20</td>
<td>22</td>
<td>22.0%</td>
</tr>
<tr>
<td>20 - 30</td>
<td>27</td>
<td>27.0%</td>
</tr>
<tr>
<td>30 - 40</td>
<td>29</td>
<td>29.0%</td>
</tr>
<tr>
<td>40 - 50</td>
<td>11</td>
<td>11.0%</td>
</tr>
<tr>
<td>50 - 60</td>
<td>7</td>
<td>7.0%</td>
</tr>
<tr>
<td>60 - 70</td>
<td>3</td>
<td>3.0%</td>
</tr>
<tr>
<td>70 - 80</td>
<td>1</td>
<td>1.0%</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Note. No significant difference in age distribution (ANOVA: F=0.005, p=.94).

In order to evaluate subjects' long-term reactions to HI, assessments were conducted no less than six months following HI (Mean: 28 months, standard deviation for MHI: 22 months, standard deviation for FHI: 18 months). Table 10 presents the distribution of time since injury.
Table 10
Time since injury for men and women in the HI group

<table>
<thead>
<tr>
<th>Time Since Injury</th>
<th>MHI Percent</th>
<th>PHI Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 months</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>6 mos - 1 yr</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td>1 yr - 2 yrs</td>
<td>32</td>
<td>22</td>
</tr>
<tr>
<td>2 - 3 years</td>
<td>28</td>
<td>23</td>
</tr>
<tr>
<td>3 - 4 years</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>Over 4 yrs</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Sum</td>
<td>100</td>
<td>72</td>
</tr>
</tbody>
</table>

Note. No significant difference in time since injury (ANOVA: F=0.000 p=.99.)

2. The Normative Sample (NS)

The national standardization sample for the MMPI-2 was chosen as the normative sample for the HI group (Butcher, Dahlstrom, Graham, Tellegen, and Kaemmer, 1989). MMPI-2 scores of the NS provide the norms against which clinicians evaluate all MMPI-2 profiles. Therefore, this sample is an adequate comparison group for clinical samples. The NS sample consists of 1138 men (MNS) and 1462 women (FNS) from communities in seven U.S. states. Further characteristics of the NS can be found in Butcher et al. (1989). Relevant demographic data for the NS are presented in table 11. Data regarding NS item endorsement frequency to MMPI-2 items published by Keller and Butcher (1991, pp. 265-277) were
used in testing hypothesis B of this study (See also Appendix E).

Table 11
Demographic characteristics of the NS and CP groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>NS</th>
<th>CP</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Men (n)</td>
<td>44 (1138)</td>
<td>53 (268)</td>
</tr>
<tr>
<td>% Women (n)</td>
<td>56 (1462)</td>
<td>47 (234)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>NS</th>
<th>CP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>41.7 40.5</td>
<td>39.8 40.3</td>
</tr>
<tr>
<td>S.D.</td>
<td>15.3 15.2</td>
<td>10.3 11.6</td>
</tr>
<tr>
<td>Range</td>
<td>18-84 17-85</td>
<td>18-74 19-76</td>
</tr>
<tr>
<td>Race</td>
<td>NS</td>
<td>CP</td>
</tr>
<tr>
<td>% White</td>
<td>82.0 80.8</td>
<td>87.9 90.6</td>
</tr>
<tr>
<td>% Black</td>
<td>11.2 12.8</td>
<td>6.2 4.5</td>
</tr>
<tr>
<td>% Asian</td>
<td>0.5 0.9</td>
<td>0.4 0.4</td>
</tr>
<tr>
<td>% Other</td>
<td>6.4 5.5</td>
<td>5.5 4.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education (years)</th>
<th>NS</th>
<th>CP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>15.0 14.4</td>
<td>11.7 12.3</td>
</tr>
<tr>
<td>S.D.</td>
<td>2.8 2.4</td>
<td>2.2 2.1</td>
</tr>
<tr>
<td>Range</td>
<td>3-20 2-20</td>
<td>3-18 3-18</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marital status</th>
<th>NS</th>
<th>CP</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Single</td>
<td>19.4 20.3</td>
<td>13.5 13.3</td>
</tr>
<tr>
<td>% Married</td>
<td>72.3 61.1</td>
<td>70.4 58.8</td>
</tr>
<tr>
<td>% Separated</td>
<td>2.0 2.3</td>
<td>4.1 3.0</td>
</tr>
<tr>
<td>% Divorced</td>
<td>5.2 11.0</td>
<td>11.6 21.9</td>
</tr>
<tr>
<td>% Widowed</td>
<td>1.1 5.3</td>
<td>0.4 3.0</td>
</tr>
</tbody>
</table>

Note. Adapted from: Keller and Butcher, 1991; P. 80.
3. Chronic Pain Sample (CP)

HI and NS endorsement frequency data were compared with those of a CP sample taken from The Chronic Pain Research Project (Keller and Butcher, 1991). The sample consisted of 268 men (MCP) and 234 women (FCP) assessed at a Minnesota pain rehabilitation program between 1985 and 1987. Further characteristics of this sample can be found in Keller and Butcher (1991). Relevant demographic data of the CP group are also presented in table 11.

**Procedure**

MMPI-2 data was collected for the HI sample and Analyses of Variance (SPSS-X ANOVA) were used to compare scale score distributions between men and women (raw data may be obtained from the author). Comparisons were made for the main clinical and validity scales, content, supplemental, and Harris-Lingoes scales.

In order to identify a correction factor for the main clinical scales, the endorsement frequency (EF) for the first 370 MMPI-2 items was compared between the NS and the HI sample (data presented in Appendix E). Comparisons were conducted separately for men and women using the respective
NS gender group. Analyses were performed following Gass’s procedure (1991), using the chi-square test for two independent samples (Siegel, 1956). Gass (1991) postulated two criteria for item selection: 1) maximal discrimination power (p<.001), and 2) clinical importance (endorsement by at least 25% of the HI sample). The discrimination power in this study was at p<.01 level.

Further analyses were conducted to identify MMPI-2 items endorsed differently by HI and chronic pain (CP) samples. Using endorsement frequency data published by Keller and Butcher (1991, presented in Appendix E), comparisons were made between a sample of chronic pain patients (CP) and the NS for the first 370 MMPI-2 items. As noted above, comparisons were conducted separately for men and women using the respective NS gender group, and analyses were performed using the chi-square test for two independent samples.

EF results from these analyses were then compared with those of the HI sample for all items with significantly different EF (i.e. items identified by comparing the HI to the normative sample). For an item to be considered "unique to the HI sample" the EF for that item had to be both significantly different from the NS and from the CP sample (p<.01).
Results

This chapter presents the statistical analyses used to test each of the hypotheses listed above and subsequent findings.

A. MMPI-2 scale scores in the HI sample

Following are comparisons of MMPI-2 scales of men and women following HI. SPSS-X Analyses of Variance (ANOVA) was used to compare scale score distributions between men and women in the HI sample. All scale elevations are relative to NS scores. (Raw data used for the following calculations may be obtained from the author).

Hypothesis A: The first hypothesis predicted gender differences on MMPI-2 profiles.

Validity and Main Clinical Scales

Table 12 presents comparisons of men and women's Validity Scales raw scores and Clinical Scales T-scores (see Appendix A for description of the scales). Raw scores were used to
calculate variance differences for the validity scales. The mean T-scores for the validity scales were all within normal limits (less than 60) in both gender groups. There were no significant differences between men and women on any validity or main clinical scales.

Both men and women showed elevated scores (T>65) on scales Hs, D, Hy, and Pt. Men also showed an elevated mean score on the Sc scale while women’s mean T-score was slightly lower than elevated level.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Men Score (SD)</th>
<th>Women Score (SD)</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale L</td>
<td>4.48 (2.29)</td>
<td>4.68 (2.11)</td>
<td>0.343</td>
<td>.56</td>
</tr>
<tr>
<td>Scale F</td>
<td>6.84 (3.78)</td>
<td>6.88 (4.45)</td>
<td>0.003</td>
<td>.95</td>
</tr>
<tr>
<td>Scale K</td>
<td>14.17 (5.28)</td>
<td>14.74 (5.31)</td>
<td>0.479</td>
<td>.49</td>
</tr>
<tr>
<td>Scale 1. Hs</td>
<td>71.09 (13.86)</td>
<td>71.71 (12.23)</td>
<td>0.092</td>
<td>.76</td>
</tr>
<tr>
<td>Scale 2. D</td>
<td>76.30 (13.11)</td>
<td>69.53 (13.54)</td>
<td>0.141</td>
<td>.71</td>
</tr>
<tr>
<td>Scale 3. Hy</td>
<td>71.01 (14.18)</td>
<td>71.96 (15.12)</td>
<td>0.177</td>
<td>.67</td>
</tr>
<tr>
<td>Scale 4. Pd</td>
<td>57.49 (11.50)</td>
<td>56.11 (11.23)</td>
<td>0.614</td>
<td>.44</td>
</tr>
<tr>
<td>Scale 5. Mf</td>
<td>49.74 (11.50)</td>
<td>50.85 (8.21)</td>
<td>0.557</td>
<td>.46</td>
</tr>
<tr>
<td>Scale 6. Pa</td>
<td>57.94 (14.63)</td>
<td>56.93 (13.08)</td>
<td>0.218</td>
<td>.64</td>
</tr>
<tr>
<td>Scale 7. Pt</td>
<td>65.62 (12.74)</td>
<td>65.29 (11.75)</td>
<td>0.030</td>
<td>.86</td>
</tr>
<tr>
<td>Scale 8. Sc</td>
<td>64.64 (13.84)</td>
<td>66.07 (13.27)</td>
<td>0.642</td>
<td>.50</td>
</tr>
<tr>
<td>Scale 9. Ma</td>
<td>52.35 (11.1)</td>
<td>52.92 (11.99)</td>
<td>0.102</td>
<td>.75</td>
</tr>
<tr>
<td>Scale 0. Si</td>
<td>55.72 (11.36)</td>
<td>55.11 (12.19)</td>
<td>0.113</td>
<td>.74</td>
</tr>
</tbody>
</table>

Note. Validity scale scores are the raw values for each scale. Clinical scale scores are given as T-scores. T-scores for scales Mf and Si are linear. Bold print - Elevated T-score (> 65).
Additional Validity and Supplemental Scales

Table 13 presents comparisons of men and women’s additional Validity and Supplemental Scales raw scores (See Appendix B for description of these scales). Mean T-scores for the additional validity scales were all less then 60 in both groups with no significant gender differences.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Men RS (SD)</th>
<th>Women RS (SD)</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>F(b)</td>
<td>3.59(3.62)</td>
<td>4.18(4.45)</td>
<td>0.918</td>
<td>.34</td>
</tr>
<tr>
<td>TRIN</td>
<td>8.76(1.29)</td>
<td>8.92(1.44)</td>
<td>0.560</td>
<td>.46</td>
</tr>
<tr>
<td>VRIN</td>
<td>5.97(2.62)</td>
<td>5.49(2.51)</td>
<td>1.476</td>
<td>.23</td>
</tr>
<tr>
<td>A</td>
<td>15.69(8.85)</td>
<td>16.60(9.58)</td>
<td>0.411</td>
<td>.52</td>
</tr>
<tr>
<td>R</td>
<td>17.35(4.50)</td>
<td>19.54(4.18)</td>
<td>10.529</td>
<td>.001*</td>
</tr>
<tr>
<td>Es</td>
<td>30.56(6.35)</td>
<td>28.04(5.77)</td>
<td>7.108</td>
<td>.008*</td>
</tr>
<tr>
<td>O-H</td>
<td>13.39(3.08)</td>
<td>14.19(2.82)</td>
<td>3.060</td>
<td>.08</td>
</tr>
<tr>
<td>Do</td>
<td>13.47(3.19)</td>
<td>13.00(3.17)</td>
<td>0.915</td>
<td>.34</td>
</tr>
<tr>
<td>Re</td>
<td>18.24(4.47)</td>
<td>20.24(4.14)</td>
<td>8.885</td>
<td>.003*</td>
</tr>
<tr>
<td>Mt</td>
<td>20.19(7.99)</td>
<td>21.17(8.07)</td>
<td>0.621</td>
<td>.43</td>
</tr>
<tr>
<td>Gm</td>
<td>33.62(5.27)</td>
<td>26.33(5.80)</td>
<td>73.602</td>
<td>.000*</td>
</tr>
<tr>
<td>Gf</td>
<td>27.83(4.78)</td>
<td>37.03(4.11)</td>
<td>173.794</td>
<td>.000*</td>
</tr>
<tr>
<td>Pk</td>
<td>14.63(8.58)</td>
<td>14.64(8.95)</td>
<td>0.000</td>
<td>.995</td>
</tr>
<tr>
<td>Ps</td>
<td>22.33(11.7)</td>
<td>23.57(12.0)</td>
<td>0.459</td>
<td>.50</td>
</tr>
<tr>
<td>Mac-R</td>
<td>21.89(3.65)</td>
<td>19.26(4.33)</td>
<td>18.549</td>
<td>.000*</td>
</tr>
</tbody>
</table>

Note. * - Significant F, P<.05.
Women had significantly higher raw scores on scales R (Repression) and Re (Social Responsibility) but the corresponding mean T-scores were within normal limits for both men and women. These average scores indicate women in the NS endorsed more R and Re items than NS men. The significant gender difference is, therefore, common and expected in the normal population and does not reflect phenomena unique to the HI sample.

As expected from the content of the scales, women had higher raw scores on scale Gf (Gender Role: Female) and men had higher raw scores on scale Gm (Gender Role: Male). Men also had significantly higher raw scores on scale Mac-R (MacAndrew Alcoholism-Revised). The corresponding T-scores for both gender groups were average, suggesting such differences were measured in the NS as well.

Both men and women showed lower than average scores on scales Do (Dominance) and Es (Ego Strength; T-score<40). These results reflect reduced assertiveness and ability to tolerate stress (Graham, 1991). The only elevated score was measured in the men’s group on scale Ps, a measure of post traumatic stress.
Content Scales

Table 14 presents comparisons of men and women's Content Scales raw scores (described in Appendix B).

### Table 14
ANOVA: Content Scale by gender

<table>
<thead>
<tr>
<th>Scale</th>
<th>Men</th>
<th>Women</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RS (SD)</td>
<td>TS</td>
<td>RS (SD)</td>
<td>TS</td>
</tr>
<tr>
<td>ANX</td>
<td>10.22 (5.70)</td>
<td>60</td>
<td>11.13 (5.29)</td>
<td>59</td>
</tr>
<tr>
<td>FRS</td>
<td>3.80 (2.66)</td>
<td>50</td>
<td>6.36 (6.66)</td>
<td>49</td>
</tr>
<tr>
<td>OBS</td>
<td>6.26 (3.72)</td>
<td>54</td>
<td>6.83 (3.94)</td>
<td>53</td>
</tr>
<tr>
<td>DEP</td>
<td>9.78 (6.14)</td>
<td>61</td>
<td>9.93 (6.77)</td>
<td>58</td>
</tr>
<tr>
<td>HEA</td>
<td>13.51 (6.88)</td>
<td>69</td>
<td>14.82 (6.76)</td>
<td>68</td>
</tr>
<tr>
<td>BIZ</td>
<td>3.13 (3.12)</td>
<td>54</td>
<td>3.01 (3.30)</td>
<td>56</td>
</tr>
<tr>
<td>ANG</td>
<td>7.16 (4.49)</td>
<td>53</td>
<td>6.75 (3.73)</td>
<td>52</td>
</tr>
<tr>
<td>CYN</td>
<td>9.34 (5.12)</td>
<td>51</td>
<td>8.46 (5.49)</td>
<td>49</td>
</tr>
<tr>
<td>ASP</td>
<td>8.26 (4.43)</td>
<td>48</td>
<td>5.82 (3.78)</td>
<td>49</td>
</tr>
<tr>
<td>TPA</td>
<td>7.81 (3.94)</td>
<td>59</td>
<td>7.51 (3.78)</td>
<td>49</td>
</tr>
<tr>
<td>LSE</td>
<td>6.85 (4.82)</td>
<td>49</td>
<td>7.72 (5.45)</td>
<td>55</td>
</tr>
<tr>
<td>SOD</td>
<td>9.30 (5.28)</td>
<td>60</td>
<td>9.40 (5.98)</td>
<td>53</td>
</tr>
<tr>
<td>FAM</td>
<td>5.98 (3.93)</td>
<td>48</td>
<td>6.26 (4.28)</td>
<td>50</td>
</tr>
<tr>
<td>WRK</td>
<td>12.43 (6.66)</td>
<td>60</td>
<td>13.32 (6.57)</td>
<td>57</td>
</tr>
<tr>
<td>TRT</td>
<td>7.32 (4.91)</td>
<td>56</td>
<td>7.21 (5.48)</td>
<td>55</td>
</tr>
</tbody>
</table>

Note. * - Significant F, P < .05.
RS - Mean Raw Score
TS - Mean T-score
Bold print - Elevated T-score (> 65)

Men had significantly higher raw scores on the ASP (Antisocial Practices) scale and women had significantly higher scores on the FRS (Fears) scale. The corresponding T-scores for these raw scores are average (ASP T-scores are
48 and 49 for men and women, respectively; FRS T-score are 50 and 49 for men and women, respectively), suggesting that women in the NS commonly endorsed more statements associated with fears than men while men, more than women in the NS, admitted thoughts and actions that could be interpreted as anti-social.

Both men and women had elevated T-scores on scale HEA (Health Concerns) suggesting awareness of many somatic symptoms. There was no difference between the number of symptoms endorsed by each group (raw scores were not significantly different, ANOVA F=1.54, p=.22).

Harris-Lingoes Subscales

Table 15 presents comparisons of men and women’s Harris-Lingoes subscale raw scores (for description of the scales see Appendix B). Men had significantly higher scores on subscales Pd2 (Authority Problems), and Mal (Amorality). These differences between the sexes appear normal, and do not reflect pathology since the corresponding T-scores are average for the NS (The mean T-scores for men were 55 on subscale Pd2 and 52 on subscale Mal).

Both men and women showed elevated scores on subscales D1
(Subjective Depression), D3 (Physical Malfunctioning), D4 (Mental Dullness), Hy3 (Lassitude-Malaise), Hy4 (Jomatic Complaints), Sc3 (Lack of Ego Mastery, Cognitive), and Sc6 (Bizarre Sensory Experience).

### Table 15

**ANOVA: Harris-Lingoes Subscales by gender**

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Men RS (TS)</th>
<th>Women RS (TS)</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>13.72 (68)</td>
<td>14.18 (65)</td>
<td>0.302</td>
<td>.58</td>
</tr>
<tr>
<td>D2</td>
<td>6.47 (49)</td>
<td>6.76 (56)</td>
<td>1.011</td>
<td>.32</td>
</tr>
<tr>
<td>D3</td>
<td>5.00 (67)</td>
<td>5.50 (67)</td>
<td>3.572</td>
<td>.06</td>
</tr>
<tr>
<td>D4</td>
<td>7.21 (84)</td>
<td>7.13 (71)</td>
<td>0.028</td>
<td>.87</td>
</tr>
<tr>
<td>D5</td>
<td>3.68 (60)</td>
<td>3.89 (57)</td>
<td>0.312</td>
<td>.58</td>
</tr>
<tr>
<td>Hy1</td>
<td>3.59 (48)</td>
<td>3.93 (51)</td>
<td>1.308</td>
<td>.25</td>
</tr>
<tr>
<td>Hy2</td>
<td>6.67 (50)</td>
<td>6.96 (50)</td>
<td>0.470</td>
<td>.49</td>
</tr>
<tr>
<td>Hy3</td>
<td>7.78 (74)</td>
<td>7.92 (71)</td>
<td>0.083</td>
<td>.77</td>
</tr>
<tr>
<td>Hy4</td>
<td>6.96 (72)</td>
<td>7.78 (68)</td>
<td>2.102</td>
<td>.15</td>
</tr>
<tr>
<td>Hy5</td>
<td>2.85 (47)</td>
<td>3.14 (47)</td>
<td>2.052</td>
<td>.15</td>
</tr>
<tr>
<td>Pd1</td>
<td>2.16 (52)</td>
<td>2.49 (53)</td>
<td>4.452</td>
<td>.25</td>
</tr>
<tr>
<td>Pd2</td>
<td>4.01 (55)</td>
<td>3.61 (52)</td>
<td>37.027</td>
<td>.000*</td>
</tr>
<tr>
<td>Pd3</td>
<td>3.65 (50)</td>
<td>3.54 (45)</td>
<td>0.155</td>
<td>.69</td>
</tr>
<tr>
<td>Pd4</td>
<td>4.93 (57)</td>
<td>4.74 (54)</td>
<td>0.312</td>
<td>.58</td>
</tr>
<tr>
<td>Pd5</td>
<td>4.94 (58)</td>
<td>4.71 (57)</td>
<td>0.346</td>
<td>.56</td>
</tr>
<tr>
<td>Pa1</td>
<td>2.44 (55)</td>
<td>2.46 (54)</td>
<td>0.003</td>
<td>.96</td>
</tr>
<tr>
<td>Pa2</td>
<td>3.19 (56)</td>
<td>3.26 (55)</td>
<td>0.065</td>
<td>.80</td>
</tr>
<tr>
<td>Pa3</td>
<td>5.06 (51)</td>
<td>5.19 (51)</td>
<td>0.061</td>
<td>.81</td>
</tr>
<tr>
<td>Sc1</td>
<td>3.34 (52)</td>
<td>4.03 (53)</td>
<td>2.220</td>
<td>.14</td>
</tr>
<tr>
<td>Sc2</td>
<td>1.72 (56)</td>
<td>1.72 (55)</td>
<td>0.000</td>
<td>.99</td>
</tr>
<tr>
<td>Sc3</td>
<td>4.84 (71)</td>
<td>5.03 (74)</td>
<td>0.224</td>
<td>.64</td>
</tr>
<tr>
<td>Sc4</td>
<td>4.73 (64)</td>
<td>4.81 (64)</td>
<td>0.034</td>
<td>.85</td>
</tr>
<tr>
<td>Sc5</td>
<td>2.19 (55)</td>
<td>2.47 (56)</td>
<td>0.915</td>
<td>.34</td>
</tr>
<tr>
<td>Sc6</td>
<td>6.14 (71)</td>
<td>6.75 (71)</td>
<td>1.006</td>
<td>.32</td>
</tr>
<tr>
<td>Ma1</td>
<td>2.25 (52)</td>
<td>1.58 (50)</td>
<td>12.440</td>
<td>.001*</td>
</tr>
<tr>
<td>Ma2</td>
<td>5.71 (52)</td>
<td>5.14 (51)</td>
<td>3.245</td>
<td>.07</td>
</tr>
<tr>
<td>Ma3</td>
<td>3.02 (47)</td>
<td>3.07 (50)</td>
<td>0.037</td>
<td>.85</td>
</tr>
<tr>
<td>Ma4</td>
<td>2.85 (49)</td>
<td>3.26 (51)</td>
<td>2.359</td>
<td>.13</td>
</tr>
<tr>
<td>Sl1</td>
<td>5.77 (53)</td>
<td>5.93 (52)</td>
<td>0.078</td>
<td>.78</td>
</tr>
<tr>
<td>Sl2</td>
<td>3.78 (53)</td>
<td>3.57 (54)</td>
<td>0.280</td>
<td>.60</td>
</tr>
<tr>
<td>Sl3</td>
<td>6.68 (55)</td>
<td>6.72 (54)</td>
<td>0.004</td>
<td>.95</td>
</tr>
</tbody>
</table>

**Note.** * - Significant F, P < .05.
RS - Mean Raw Score
TS - Mean T-score
Bold print - Elevated T-score (> 65)
B. Item endorsement frequency (EF) analysis - HI sample

Hypothesis B: The second hypothesis predicted endorsement frequency comparison of HI and the NS would yield correction factors for scales Hs, D, Hy, Pt, and Sc in MMPI-2 profiles of HI men and women.

Of the 370 item comparisons conducted, a differential response frequency was found in 121 analyses for men and in 110 analyses for women. Of these, 60 items were shared by both men and women. Table 16 presents the distribution of items endorsed significantly differently by men, women, and by both men and women among the three main validity scales and the main clinical scales. The percentage of these items from the total number of items on each scale is also presented. Items often contribute to the elevation of more than one scale. Therefore, the sums of all items in the table are larger than the numbers noted above.

For some items an EF difference did not imply contribution to scale elevation. For example, item 116 ("Often I can't understand why I have been so irritable and grouchy") was more frequently endorsed "True" by the HI sample (p<.00). While a "false" response to that item would contribute to the elevation of scales K and Hy, the more frequent "true"
response would not register on any scale. This item, and
others like it, were not included in Table 16.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Men</th>
<th>Women</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N/Tot %</td>
<td>N/Tot %</td>
<td>N/Tot %</td>
</tr>
<tr>
<td>Scale L</td>
<td>3/15 20.0</td>
<td>4/15 26.6</td>
<td>1/15 6.6</td>
</tr>
<tr>
<td>Scale F</td>
<td>7/60 11.6</td>
<td>6/60 10.0</td>
<td>4/60 6.6</td>
</tr>
<tr>
<td>Scale K</td>
<td>2/30 6.6</td>
<td>2/30 6.6</td>
<td>2/30 6.6</td>
</tr>
<tr>
<td>Scale 1. Hs</td>
<td>23/32 71.8</td>
<td>20/32 62.5</td>
<td>14/32 43.7</td>
</tr>
<tr>
<td>Scale 2. D</td>
<td>27/57 47.3</td>
<td>25/57 43.8</td>
<td>17/57 29.8</td>
</tr>
<tr>
<td>Scale 3. Hy</td>
<td>25/60 41.6</td>
<td>20/60 33.3</td>
<td>15/60 25.0</td>
</tr>
<tr>
<td>Scale 4. Pd</td>
<td>19/50 38.0</td>
<td>11/50 22.0</td>
<td>7/50 14.0</td>
</tr>
<tr>
<td>Scale 5. Mf</td>
<td>17/56 30.3</td>
<td>15/56 26.7</td>
<td>7/56 12.5</td>
</tr>
<tr>
<td>Scale 6. Pa</td>
<td>7/40 17.5</td>
<td>10/40 25.0</td>
<td>5/40 12.5</td>
</tr>
<tr>
<td>Scale 7. Pt</td>
<td>19/48 39.5</td>
<td>25/48 52.0</td>
<td>16/48 33.3</td>
</tr>
<tr>
<td>Scale 8. Sc</td>
<td>24/78 30.7</td>
<td>25/78 32.0</td>
<td>19/78 24.3</td>
</tr>
<tr>
<td>Scale 9. Ma</td>
<td>10/46 21.7</td>
<td>8/46 17.3</td>
<td>5/46 10.8</td>
</tr>
<tr>
<td>Scale 0. Si</td>
<td>16/69 23.1</td>
<td>15/69 21.7</td>
<td>6/69 8.6</td>
</tr>
</tbody>
</table>

Note. EF - item endorsement frequency
N - number of items contributing to scale elevation
Tot - total number of items on the scale
% - percentage of N from Tot for each scale.

For both men and women higher EF was found for more than 25% of scale items on scales Hs, D, Hy, and Pt. For men, higher EF accounted for more than 50% of items on scale Hs; for more than 30% on scales D, Hy, Pd, Mf, Pt, and Sc; and for
more than 20% on scales L, Ma, and Si. For women, higher EF accounted for more than 50% of items on scales Hs and Pt; for more than 30% of items on scales D, Hy and Sc; and over 25% of items on scales L, Mf, and Pa.

C. Item EF comparisons of HI and CP samples

**Hypothesis C1** The third hypothesis predicted EF comparison of HI and CP samples would identify MMPI-2 items related specifically to brain injury.

Fifty eight such items were identified for men and 53 items for women. Eighteen of these items were common to both men and women.

Table 17 presents the distribution of MMPI-2 items unique to the HI sample among the main validity and clinical scales. The number of items for each scale, as well as the percentage of these items from the total number of scale items, is presented for men, women, and for both.

As previously noted, items often contribute to the elevation of more than one scale. Therefore, the sums of all items in the table are larger than the number of identified items noted above. Items with significantly different EF which
did not contribute to scale elevation were not included in Table 17.

### Table 17

**Scale distribution of items unique to the HI sample**

<table>
<thead>
<tr>
<th>Scale</th>
<th>Men</th>
<th>Women</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N/Tot %</td>
<td>N/Tot %</td>
<td>N/Tot %</td>
</tr>
<tr>
<td>Scale L</td>
<td>2/15 13.3</td>
<td>1/15 6.6</td>
<td>0/15 0.0</td>
</tr>
<tr>
<td>Scale F</td>
<td>4/60 6.6</td>
<td>2/60 3.3</td>
<td>1/60 1.6</td>
</tr>
<tr>
<td>Scale K</td>
<td>0/30 0.0</td>
<td>2/30 6.6</td>
<td>0/30 0.0</td>
</tr>
<tr>
<td>Scale 1. Hs</td>
<td>7/32 21.8</td>
<td>6/32 18.7</td>
<td>2/32 6.2</td>
</tr>
<tr>
<td>Scale 2. D</td>
<td>11/57 19.2</td>
<td>6/57 10.5</td>
<td>3/57 5.2</td>
</tr>
<tr>
<td>Scale 3. Hy</td>
<td>9/60 15.0</td>
<td>7/60 11.6</td>
<td>2/60 3.3</td>
</tr>
<tr>
<td>Scale 4. Pd</td>
<td>8/50 16.0</td>
<td>4/50 8.0</td>
<td>3/50 6.0</td>
</tr>
<tr>
<td>Scale 5. Mf</td>
<td>12/56 21.4</td>
<td>10/56 17.8</td>
<td>3/56 5.3</td>
</tr>
<tr>
<td>Scale 6. Pa</td>
<td>2/40 5.0</td>
<td>5/40 12.5</td>
<td>2/40 5.0</td>
</tr>
<tr>
<td>Scale 7. Pt</td>
<td>6/48 12.5</td>
<td>12/48 25.0</td>
<td>5/48 10.4</td>
</tr>
<tr>
<td>Scale 8. Sc</td>
<td>12/78 15.3</td>
<td>16/78 20.5</td>
<td>9/78 11.5</td>
</tr>
<tr>
<td>Scale 9. Ma</td>
<td>7/46 15.2</td>
<td>8/46 17.3</td>
<td>3/46 6.5</td>
</tr>
<tr>
<td>Scale 0. Si</td>
<td>9/69 13.0</td>
<td>6/69 8.6</td>
<td>3/69 4.3</td>
</tr>
</tbody>
</table>

**Note.** N - number of items contributing to scale elevation  
Tot - total number of items on the scale  
% - percentage of N from Tot for each scale.
Unique HI items common to both men and women are listed in Appendix C. These items represent over 10% of items on scales Pt and Sc. Interestingly, five of the eighteen items also appear on Gass's correction factor (1991) and eight are included among the 23 items on Alfano et al.'s correction factor (1990). A comparison of item lists from Gass's, Alfano's and the current study can be found in Appendix F.

Unique HI items for men represent over 20% of items on scales Pt and Sc, and over 10% of items on scales Hs, D, Hy, Mf, Pa, and Ma. Included in this list of 58 items are 7 of Gass's items (two items in addition to the 5 items noted above).

Unique HI items for women represent over 20% of items on scales Hs and Mf, and over 10% of items on most other scales. The 53 items unique to HI women also includes 7 of Gass's items (two items in addition to the 5 items noted above).
Discussion

A. MMPI-2 scores for men and women following HI

Main Clinical Scales

Contrary to the first hypothesis, no significant differences were found between the main scales scores of men and women following HI. Consistent with the literature reviewed above, HI individuals of both gender groups had elevated scores on scales Hs, D, Hy, Pt, and Sc (Alfano et al., 1990). This consistent response pattern suggests the MMPI-2 is equally valid as a measure of emotional adjustment in men and women. In the absence of any other gender differences these results would indicate no need for a separate MMPI-2 correction factor for men and women.

Supplemental and Content Scales

Little research has been conducted regarding the response pattern of HI individuals on any MMPI-2 measures other than the main clinical scales. A possible reason for this paucity is that the validity and reliability of many of the
supplemental scales are questionable as they are based on limited dated research done with the MMPI (Graham, 1990). Thus, current clinical interpretations of any of the supplemental scale scores should be made cautiously. The results of this study were not expected to improve the quality of scale scores interpretation but rather offer an opportunity to examine HI response pattern for most of the additional scales commonly used with the MMPI-2. As can be seen in Table 13, HI individuals generally score within normal limits on most of the supplemental scales. Highly elevated or depressed scores on the MMPI-2 of an HI individual may, therefore, indicate an unusual response pattern possibly requiring further investigation and intervention. Following is a discussion of results outside of the normal limits for supplemental and content scales.

Gender differences were not identified on any of the supplemental or content scales nor on any of the Harris-Lingoes subscales (discussed later). When men and women’s scale raw scores were compared, statistical differences were identified for several of the scales (e.g. scales Es, Re, ASP); however, the transformation of raw scores into their respective T-scores diminished any statistical differences. It is reasonable to conclude, therefore, that similar raw score differences were observed in NS protocols and were incorporated in the calculation of an average gender
response represented by an average T-score.

Only one elevated T-score was noted among the supplemental scales: an elevated Ps (Post Traumatic Stress Disorder) score for HI men (women's mean T-score for that scale was just short of elevated level; T-score=64). The MMPI-2 includes two scales which purport assessment of post traumatic stress disorder (PTSD): the Pk scale and the Ps scale. The more veteran of the two, the Pk scale, comprises 46 items suggesting emotional distress, anxiety, sleep disturbance, guilt, and unwanted thoughts (Graham, 1990). In its original form (Keane, Malloy, and Fairbank, 1984) the scale was used to classify male Vietnam veterans with or without PTSD diagnosis and was able to do so with 82% classification accuracy (cutoff raw score=30). The suggested cutoff raw score for the MMPI-2 is 28, or T-score of 83 for males and 79 for females (Lyons and Keane, 1992). The Pk scale mean T-score was not elevated for either men or women in the HI sample suggesting that PTSD was not a common reaction in that sample.

According to Graham (1990), the Ps scale is an experimental scale comprising 60 items, 45 of which are also included in the Pk scale. Scale items were selected based on their ability to differentiate Vietnam veterans with PTSD from those diagnosed with psychiatric disorders and Vietnam
veterans with no known complaints. The validity and reliability of this scale have not been adequately tested to date (Graham, 1990).

Given that most of the Pk scale items are included in the Ps scale, a higher Ps score would suggest the difference is due to the endorsement of Ps items unique to that scale. To test this possibility the items of the two scales were compared. Surprisingly, instead of the expected 45, only 26 Pk items were common to both scales while twenty items were unique to the Pk scale and thirty four were unique to the Ps scale. The examination of unique items suggested many of the Ps scale items describe poor physical health (e.g. item 141: "During the past few years I have been well most of the time"), reduced concentration and memory (e.g. item 299: "I cannot keep my mind on one thing"), and poor emotional control (e.g. item 116: "often I can’t understand why I have been so irritable and grouchy"). While such symptoms may be consistent with a PTSD diagnosis, they are also consistent with common HI sequelae (Lishman, 1987) explaining the elevated scores of HI individuals on that scale.

In summary, Ps scale elevations in the HI sample are likely the result of frequent endorsement of items describing common post concussive symptoms rather than PTSD. Further research is recommended before either the Pk or Ps scale can
be used to assess PTSD in HI since their validity and reliability have not been tested for that population. Classification accuracy using these scales should be evaluated in comparison to a separate diagnostic process (e.g. clinical interview) following which a specific cutoff score might be identified for HI populations.

No other elevations were noted on the supplemental scales of HI individuals but both gender groups showed low scores which are of interest. Both men and women had lower than average scores (T-score<40) on scales Do (Dominance) and Es (Ego-strength), two scales that deserve further attention. Items on the Do scale deal with several content areas loosely associated with assertiveness, i.e. self-confidence, social discomfort, physical appearance, concentration, perseverance, and political opinions (Graham, 1990). A low score on the Do scale suggests submissive behavior, low self-concept, pessimism and inefficiency (Graham, 1990), consistent with the psychosocial consequences of brain injury (Prigatano, 1986). Low scores would, therefore, be expected for HI individuals and may indicate a need for increased psychological support. But are these individuals likely to benefit from such intervention and could the MMPI-2 predict therapeutic success?

The Es scale was developed to predict a person's ability to
benefit from individual psychotherapy by selecting those items which differentiated improved and unimproved neurotic patients following treatment (Barron, 1953). The resulting scale claimed to assess coping ability, and perceived personal adequacy but also includes items dealing with physical well being, anxiety, and the client's sense of reality. Barron (1953) was not convinced the correlation between Es score and treatment outcome was sufficient to predict therapeutic success and suggested that the scale be used cautiously to measure psychological adjustment rather than predict outcome (Barron, 1953, Kleinmuntz, 1960). Further research failed to replicate Barron's findings, showing no significant relationship between Es scale scores and therapy outcome (Getter and Sundland, 1962). Graham (1990) suggested interpreting low Es scores as indicating poor psychological adjustment and difficulties dealing with daily stress. Additional interpretations include feelings of worthlessness, helplessness, confusion, fatigue, and social withdrawal.

In summary, low scores were found on scales Do and Es suggesting psychological maladjustment. While Es scores may not predict improvement following psychotherapeutic intervention, the above findings indicate HI individuals experience feelings of worthlessness, helplessness, and hopelessness suggesting a need for additional emotional
When MMPI-2 content scales were examined, raw score differences were found between men and women on scales FRS and ASP. Similarly to supplemental scale findings, when the raw scores were transformed to T-scores statistical differences diminished and scores were average. Elevated scores were noted only on one scale (HEA: Health Concerns), consistent with elevations on main scale Hs and the endorsement of physical complaints on the Ps scale. A similar pattern was found on the only other study reporting content scale scores in a post concussive sample (Youngjohn, Burrows, and Erdal, 1993).

**Harris-Lingoes Scales**

The Harris-Lingoes subscales provide additional information regarding content components contributing to main scales elevations. Following is a discussion of subscale elevations for three of the five main scales which were elevated in the HI sample (scales D, Hy, and Sc). There are no subscales available for the two other main scales (Hs and Pt). As noted above, no gender differences were found between HI men and women on the Harris-Lingoes scales.
Three of the five subscales of the main D scale were elevated suggesting HI individuals are concerned about lack of energy, memory and concentration problems, and reduced self confidence (D4—Mental Dullness); unhappiness, nervousness, and lack of interest in their surroundings (D1—Subjective Depression); and physical malfunctioning (D3). Subscales D2 (Psychomotor Retardation) and D5 (Brooding) did not contribute to scale D elevation indicating that social withdrawal and increased sensitivity are as common in the HI population as in the NS.

Two of the five subscales of the HY scale were elevated. Both these subscales (Hy3 and Hy4) include items describing somatic concerns such as sleep disturbance, poor balance, nausea, and fatigue. Other components of the Hy scale were within normal limits indicating that HI individuals do not have higher than average need for affection (Hy2), are not more extroverted (Hy1), nor do they deny any aggressive impulses (Hy5) more than the NS.

Two of the five Sc subscales were also elevated. Consistent with the content of the above elevated subscales the two Sc subscales describe difficulties in concentration and memory (Sc3—Lack of Ego Mastery, Cognitive) and unusual sensations such as numbness or paralysis of certain body parts, or noise sensitivity (Sc6—Bizarre sensory experiences). These
subscales also include items describing feelings of unreality and loss of control over thought process and content.

Another subscale (Sc4-Lack of Ego Mastery, Conative) was just short of elevated level (T-score=64 for both men and women) suggesting HI individuals are also depressed, worried, and concerned more than average with difficulties coping with daily stresses. Though not quite elevated, the content of this subscale is consistent with the content of scales D and Pt, both of which were elevated. Other Sc subscales were not elevated indicating HI individuals do not experience more social and self alienation than the NS (Sc1 and Sc2), nor do they feel increased difficulty inhibiting impulses or emotions (Sc5).

The findings for scales D, Hy, and Sc are consistent with those reported by Gass and Russell (1991). The same subscales were frequently elevated in their sample of 58 men with closed head injury. Their finding of a frequently elevated score on subscale Ma2 (Psychomotor acceleration) was not replicated in this study.

In summary, no gender differences were noted on the Harris-Lingoes subscales. Subscale scores suggest that main scale elevations are most likely the result of many concerns
regarding physical and cognitive malfunctioning expressed by HI individuals.

**Summary**

Elevated scale scores were found for five of the main MMPI-2 scales in both gender groups, consistent with previous research. The examination of supplemental content scales and subscales suggested HI individuals show average scores on most scales. Elevated scores were noted on scales which include many items describing physical and cognitive difficulties, supporting the notion that an elevated MMPI-2 profile reflects physical and neuropsychological concerns rather than emotional distress (Cripe, 1991).

Evidence of emotional distress and psychological maladjustment were suggested not by scale elevation but rather in the low scores found on two of the supplemental scales which assess coping skills and self-concept. This finding stresses the need to consider the general pattern of MMPI-2 scores, including significantly low scores, in evaluating HI individuals. Further research is needed to evaluate the effect of psychotherapy in reducing the distress indicated by these low scale scores.

Contrary to the first hypothesis, no gender differences were
found on any of the MMPI-2 main scales, subscales, content or supplemental scales for HI individuals. Based on these results separate correction factors for men and women are not indicated. Item endorsement frequencies (EF), evaluated in sections B and C of this chapter, were calculated separately for men and women though no significant differences were expected for the two gender groups.
B. MMPI-2 correction factor for men and women with HI

Both men and women had higher EF for many items on scales Hs, D, Hy, Pt, and Sc. The largest proportions of items with higher EF for either men (71.8%) or women (62.5%) were found on scale Hs which is considered homogenic for physical symptoms (Graham, 1991). This finding supports the notion that somatic complaints are a major concern for HI individuals and MMPI-2 elevations may be attributed to the endorsement of items reflecting pain experience rather than emotional distress (Cripe, 1991).

Scale Pt also includes several items describing physical complaints and concentration difficulties, which may explain the high number of items more frequently endorsed by HI individuals. The 16 Pt items endorsed more frequently by both men and women described phenomena consistent with post concussive symptoms (e.g. Item 31: "I find it hard to keep my mind on a task or job"). Nine additional Pt items, more frequently endorsed by women, describe reduce self-esteem, emotional lability, and social fears. Since the purpose of a correction factor is to correct for elevations caused by somatic complaints it is suggested that items used would be the sixteen items shared by men and women pertaining to somatic concerns.
For scales D and Hy each item’s association with one of the Harris-Lingoes subscales was assessed in order to evaluate the number of items the content of which reflects physical complaints. Of the items shared by both gender groups, all fifteen Hy items with higher EF are associated with subscale Hy3 (Lassitude-Malaise) or Hy4 (Somatic complaints). It can be concluded, therefore, that all shared Hy scale items more frequently endorsed by HI individuals describe physical symptoms.

EF analysis of D scale items endorsed by HI men and women seemed to present a different pattern. Only 5 of the 17 shared D scale items with higher EF reflected clear physical complaints as identified by the Harris-Lingoes subscales (4 items associated with subscale D3: Physical malfunctioning; one item was associated with subscale D4: Mental dullness). Eleven items were associated with subscale D1: Subjective depression (two additional items were associated with subscale D1 as well as with D3 or D4; one item was not associated with any subscale). Since subscale D1 claims to deal with the subjective experience of depressed mood one might assume that it represents an emotional reaction free of somatic components. Unfortunately, many of the items suggested by subscale D1 describe cognitive difficulties that may be associated with depression (e.g. Item 31 noted above) as well as post concussive symptoms. As such, all
shared D scale items may be considered associated with somatic complaints and used in a correction factor.

Ten of the 19 Sc items more frequently endorsed by both men and women contribute to scale elevations on scales Hs, D, Hy and Pt and their content was discussed above. Of the remaining nine items six describe "Bizarre sensory experiences" (subscale Sc6), and the other three describe concentration difficulties (item 299), concern with cognitive functioning (item 180), and a feeling of being misunderstood (item 22). All six items may be used in a correction factor since they describe post concussive reactions.

**Summary**

Compared to the NS, both men and women following HI had significantly different EF for a large proportion of items associated with scales Hs, D, Hy, Pt and Sc. This finding is consistent with hypothesis B predictions. Qualitative analysis suggests most of these items describe physical complaints and post concussive symptoms. This finding stresses the need for cautious interpretation of MMPI-2 scale elevations and supports previous research recommending the use of a correction factor for the inventory (Alfano et
al., 1990; Cripe, 1991). Since no significant differences were found between scale elevations of men and women it is suggested that a correction factor be constructed using items with significantly different EF shared by both gender groups.

Based on EF and content analysis this study suggests a correction factor comprising forty two items (out of the sixty items shared by men and women) from scale Hs, D, Hy, Pt, and Sc (listed in Appendix D). The number of items included in the list pertaining to each scale is more than sufficient to elevate an average scale score to a significant level (e.g. the list includes 15 Hy items while the endorsement of only seven additional items is sufficient to elevate the Hy scale from a T-score of 50 to a T-score>65).

Comparison with other correction factors offers partial validation of the list in as much as it includes 16 of the 23 items suggested as a correction factor by Alfano et al. (1990) and 11 of the 14 items suggested by Gass (1991). The three item lists were constructed using different statistical methods and patient populations yet are surprisingly similar.
C. Chronic pain and the correction factor for HI

Somatic complaints associated with chronic pain, when endorsed on the MMPI-2, result in elevations of scales Hs, D, Hy, and content scale HEA (Keller and Butcher, 1991). Before any use is made of the correction factor for HI suggested in the previous section of this chapter it is important to clarify the possible contribution of chronic pain (CP) to the differences between the NS and HI groups. As expected, a comparison of endorsement frequency showed many of the items previously considered HI related were similarly endorsed by a CP sample. A reasonable conclusion, therefore, would be that a large proportion of MMPI-2 elevations following HI are not related to post-concussive reaction. Rather, these elevations may be attributed to the endorsement of items which describe somatic complaints associated with other injuries incurred during the MVA (i.e., bone and soft tissue injuries).

Eighteen items shared by men and women were identified showing significantly different EF from the NS as well as from the CP sample. This study proposes that these eighteen items may be considered unique to HI. The eighteen item list (Appendix C) likely does not reflect the presence of peripheral aches and pains and may, therefore, serve as a
correction factor specifically for HI related symptoms. As predicted, items on the list contributed to the elevation of scales Pt and Sc more than other scales (10.4 and 11.5 percent of items, respectively). The addition of these items to an otherwise average MMPI-2 profile is likely to result in the elevation of scale Sc but may not be sufficient to elevate scale Pt. When used to correct an elevated profile this correction factor is likely to reduce scales Sc and Pt elevations to normal levels unless anxiety level (as reflected on scale Pt) is quite high.

Summary

A comparison between HI and CP samples yielded an eighteen item list which may be considered "HI unique". Items on the list do not reflect the complaints associated with CP and may serve as a MMPI-2 correction factor for specific HI effects. List items contribute to the elevation of scales Pt and Sc more than other scales.
D. Conclusions

1. This study compared MMPI-2 profiles of men and women following HI and found no significant differences between gender groups on any of the MMPI-2 scales commonly used by clinicians.

2. MMPI-2 elevations following HI may be expected on main scales Hs, D, Hy, Pt, and Sc; on supplemental scale Ps; and on content scale HEA. Elevated scores on validity scales or any other clinical scale are not expected and if observed may indicate an unusual response pattern which requires further investigation. Low scores on content scales Es and Do likely reflect difficulties in coping with life changes as a result of HI and a need for additional support.

3. Elevated MMPI-2 scores following HI reflect many somatic complaints associated with chronic pain as well as post concussive symptoms. To reduce the effect of these complaints on MMPI-2 elevations it is recommended to rescore the profile following the elimination of the relevant items. Appendix C lists items associated with brain injury related complaints while Appendix D includes additional somatic concerns likely associated
with chronic pain.

This study supports previous findings showing head injury survivors tend to have typically elevated MMPI-2 profiles similar to those found for medical and neurological patients. These elevations are likely due to the endorsement of a combination of statements—some related to changes in the person’s emotional adjustment, some related to symptoms of chronic pain, and some related to the effects of head injury and related issues. This study offers a way to identify some of these components and draws attention to the influence they have on MMPI-2 profiles. Further validation of the item lists is required prior to the usage of the correction factors identified in this study. Following such validation the application of these correction factors should be considered carefully since the elimination of items from a questioner changes the instrument and raises questions regarding the validity of the remaining items.
E. Cluster Analysis of MMPI-2 Profiles

One of the difficulties in comparing the mean scores of large groups is the danger of intra-group differences cancelling one another. As a result, statistical comparisons are made between mean scores which do not adequately represent any of the individuals in the groups (Mack, 1979). In the area of chronic pain research it has been suggested the reactions to CP are not uniform, and the search for a mean MMPI profile for the group may result in an average pattern which does not describe any specific individual (Keller and Butcher, 1991). A more accurate depiction of chronic pain patients would require categorization into several sub-groups, each with its own MMPI profile.

Using cluster analysis, a statistical method of grouping individuals based on the similarity of their pattern of scores (Norusis, 1985), researchers attempted to identify replicable subgroup patterns of MMPI profiles for CP individuals. Bradley, Prokop, Margolis, and Gentry (1978) compared cluster analysis results of three consecutive groups of men and women with CP. They identified several profile patterns which were replicated across the three samples. For women they found four replicable profile
types. The largest group (39% of the population) showed a profile within normal limits with relatively high points on scales K, Hs, and Hy. A second group (23% of the population) was characterized by an elevation of scales Hs, D, and Hy (the "neurotic triad" scales). A third group (24% of the population) had marked elevations on scales Hs and Hy ("conversion-V" pattern), and the last group (13% of the population) showed elevations on scales Hs, D, Hy, Pt, and Sc ("general elevation").

For men the study identifies three replicable MMPI pattern groups. Two of these were similar to those found for women: the neurotic triad pattern (44% of the population) and the normal limits pattern. The third group (10% of the sample) resembled the general elevation group found in women with the addition of an elevation on the Pd scale. The conversion-V pattern was not found for men.

These results were surprisingly similar to those suggested earlier by Sternbach (1974) based on clinical judgement. Sternbach evaluated the MMPI profiles of pain patients who participated in a treatment program which included psychological, psychiatric, and physical therapies. In that population he identified four clusters: the neurotic-triad pattern, the conversion-V pattern (somatization reaction), a third pattern showing elevated D scores which he named
"reactive depression", and a fourth pattern called "manipulative reaction" showing elevated scales Hs, D, Hy, and Pd. The sample was small (15 subjects per subgroup at most) and the clustering was based on Sternbach's clinical judgement only. Nonetheless, Sternbach predicted that the best treatment response could be achieved in pain patients with a depressive response pattern or a conversion-V pattern. The least likely to benefit from treatment, in Sternbach's experience, were clients with an elevated neurotic triad.

Similar pattern groups were identified in another study using a different CP sample (Prokop, Bradley, Margolis, and Gentry, 1980). This time subgroup patterns could be replicated only across two out of three consecutive gender samples. For women the study identified three patterns: the normal limits profile, the neurotic triad profile, and the conversion-V profile. The first two patterns were also found for two of the men samples. A third subgroup showed general elevation and a fourth subgroup showed a peak elevation on scale D.

Further study offered additional replication of previous findings in a sample of 240 men (Armentrout, Moore, Parker, Hewett, and Feltz, 1982), and a sample of 77 women (Bernstein and Garbin, 1983). The cluster analysis of the
female sample replicated Sternbach's manipulative reaction group in addition to the other four clusters found by Bradley et al. (1978).

McCreary (1985) found four subgroups for both men and women (neurotic triad, general elevation, unelevated neurotic triad, and an unelevated manipulative reaction pattern). A fifth profile type showing a conversion-V pattern was found only for women. In a mixed gender sample Rosen, Grubman, Bevins, and Frymoyer (1987) were able to replicate three of the subgroup patterns (Conversion-V, neurotic triad, and general elevation), as well as two non-elevated groups (accounting for 62% of the sample).

The correlation between MMPI patterns and treatment outcome in CP populations has been inconclusive. Some attempts were made to test Sternbach's (1974) predictions with variable success. While McGill, Lawlis, Selby, Mooney, and McCoy (1983) did not find any correlation between MMPI profile and treatment response, McCreary (1985) reported some correlates found in his sample. As could be expected, individuals with unelevated profiles showed overall better treatment response than those with elevated profiles. However, contrary to Sternbach's account, McCreary found that of the elevated profile groups the one showing a neurotic-triad pattern for women had the best treatment response. No differences in
outcome prediction were found among the elevated profile subgroups of men. McCreary also found individuals with unelevated MMPI profiles were more likely to be employed while those with general elevation or conversion-V patterns were more often unemployed. A similar finding was reported by Rosen et al. (1987).

In summary, three MMPI profile patterns are commonly replicated when cluster analysis is performed on MMPI profiles of men and women with CP. The three patterns most commonly found are: a) within normal limits, b) neurotic triad pattern, and c) general elevation pattern. A fourth pattern, conversion-V, seems to be more prevalent among women but may be found for men as well. Less common, yet found for both sexes, are patterns possibly representing depressive or manipulative reactions. Additionally, there is some indication that the normal-limits pattern may not be homogeneous, and that smaller subgroups may be identified among these profiles.

The current study, using the MMPI-2 with HI subjects, yielded scale elevations consistent with previous HI as well as CP research data. It was, therefore, hypothesized that cluster analysis of HI MMPI-2 profiles would yield pattern groups similar to those found for CP. As in the study of CP, the identification of HI clusters could be the first
step in predicting the efficacy of different treatments and
the likelihood of the client's return to work (Sternbach,
1974; McCreary, 1985; Rosen et al., 1987).

Results of clustering were not predicted at the time this
study's other hypotheses were formulated. Following the
analysis of group scores it was felt that cluster analysis
could add to our understanding of MMPI-2 profiles in HI
populations. This post-hoc analysis could not be reported
in the main body of the study but its results will be
described and discussed henceforth.

For the purpose of identifying MMPI-2 clusters in the HI
sample the SPSS-X statistical analysis program was utilized,
using Ward's method of minimum distance clustering with the
squared euclidian distance as metric. Clusters were
determined examining inter-cluster coefficients and looking
for discontinuity, as well as examining the clusters
themselves for clinical relevance. six distinct clusters
were identified for the male sample and five clusters were
found for the female sample. Figure 1 illustrates the mean
MMPI-2 profiles derived for the Six male clusters.
Figure 1. Mean MMPI-2 profiles for Male subgroups.
Three elevated profile groups were identified among the men (N=100). The largest group (36% of the sample) showed elevations on scales Hs, D, and Hy, with a slight elevation on scale Pt (T-score=65.44). This pattern is similar to the neurotic-triad profile described by Sternbach (1974). The second group (23% of the sample) showed elevations on scales F, Hs, D, Hy, Pd, Pa, Pt, and Sc, suggesting a general-elevation pattern. The third elevated profile resembles Sternbach’s (1974) reactive depression pattern, showing elevations on scales D, and Si. Representing only 9% of the sample, this group seems to have a distinctly different response pattern suggesting depression and social withdrawal are more troublesome than somatic complaints and anxiety.

A large group of men’s profiles could be considered within-normal-limits (32% of the sample). This group was not homogeneous allowing the identification of three subgroups. The largest of those (22% of the men’s sample) showed a sub-clinical neurotic-triad group previously described by Rosen et al. (1985). The second subgroup (7% of the sample) showed a slight elevation on scale Pt (T-score=65.89) with sub-clinical elevations on scales Sc, D, Ma, and F. This subgroup might be considered a sub-clinical version of the general-elevation pattern. The smallest of the normal-limits subgroups (only 3% of the sample) showed the lowest scores on the main clinical scales with lower than average
scores on scales Pd, Mf, and Pa. Individuals with a similar MMPI-2 pattern may be considered rigid, conforming, guarded, and having limited interests (Graham, 1990). Since the pattern was generally within normal limits it may reflect an adequate coping style for the HI individual. On the other hand, in this population a restricted and guarded response style may indicate inadequate coping which may require further intervention. This pattern has not been described previously and its validity should be tested in another sample.

Of the five clusters identified for the women sample (N=72) four clusters showed elevated patterns and a fifth showed an average profile. The largest of the cluster groups (36% of the sample) showed a pattern similar to the general elevation profile found in men, with a sub-clinical elevation on scale Pd (T-score=62.08). The second group (21% of the sample) showed a pattern similar to the neurotic-triad pattern found in men, with slight elevations on scales Pt (T-score=66.2) and Sc (T-score=65.8). The third group (12.5% of the sample) showed a less elevated version of the previous pattern. This attenuated pattern showed elevations only for scales Hs and Hy, forming a conversion-V pattern (Bradley et al., 1978). A fourth elevated pattern was found for 4% of the sample with peak elevations on scales D and Pt. This pattern (*depressed and
anxious") is probably similar to Sternbach's reactive depression pattern as seen for women. The normal-limits profile in the women's sample (26% of the sample) was quite homogenic showing no remarkable sub-clinical elevations or lower than average scores. Figure 2 illustrates the mean MMPI-2 profiles derived for the five women clusters.

In summary, this analysis replicated many of the MMPI patterns previously described for CP patients. A large proportion of HI individuals showed MMPI-2 profiles with unelevated scores. Elevated profiles were not homogeneous suggesting treatment approaches may have to be adapted to the client's response style in order to achieve the best results.

Further research is required to replicate any or all of the subgroups in another HI sample, while maintaining a recommended 5:1 ratio of subjects to variables (McCreary, 1985). Following such replication research may be conducted to address the question of differential treatment responses among the subgroups.
Figure 2. Mean MMPI-2 profiles for female subgroups.
The failure of available research to show conclusive correlations between MMPI and treatment response should not discourage further study of this question. The most likely reasons for the variance in results are methodological problems including small sample size and the use of different clustering methods, as well as nonstandardized treatments and outcome measures. One may hope further research will provide better predictive ability for CP as well as HI populations.
F. Limitations of the present study and future research

The assessment of individuals following HI is a complex process of data collection regarding physical, cognitive, and emotional sequelae. It is important to acknowledge this study is concerned only with the aspect of emotional reaction as measured by a specific tool— the MMPI-2. Any applications resulting from this study are limited to this aspect.

When generalizing from this study to other HI individuals it is also important to note generalizability is limited to the litigious HI population. The demographic data provided in this study indicates the sample is not representative of the B.C. general population (due to disproportionate race distribution). Neither is it representative of HI populations in general since it is comprised solely of individuals who were involved in personal injury claims. This population is often suspected of misrepresentation of symptoms and the question of how motivational factors may have affected this study’s results should be addressed.

Predictions regarding long-term HI effects for the purpose of personal injury claims are often requested of neuropsychologists although data regarding litigious HI
individuals is limited. Much of the research of HI has been conducted in hospitals and rehabilitation units (e.g. Levin, Gary, et al., 1987) not taking into account the possibility of litigation changing test results. Other research (e.g. Lamb, Berry, Wetter, and Baer, 1994) has concentrated on the question of malingering using college students to simulate the effects. While providing important information neither one of these paradigms reflect accurately results of the population in question. The current study provides data regarding the demographics as well as MMPI-2 profiles for non-hospitalized HI individuals in litigation and offers an opportunity to evaluate motivational effects in that population. As with all research, the results of this study will require replication to validate its findings.

As noted above, the concern most often raised regarding MMPI profiles of individuals in litigation is the possible affect of malingering on test results. Psychologists would like to know 1) how often motivational factors effect the individual's response style and 2) whether elevated MMPI profiles which reflect actual emotional distress can be discriminated from those showing exaggerated symptoms in order to gain sympathy or monetary compensation.

Research to date indicates the MMPI, while better than other personality inventories, exhibits limited ability to
identify malingering (Butcher and Harlow, 1987; Schretlen, 1988). Furthermore, there is evidence that knowledge of psychological symptoms of HI and of MMPI-2 validity scales may assist a potential simulator in producing a profile which could not be distinguished from those of truthful responders (Lamb et al., 1994). Within these limitations it is important to note the following regarding the current study:

1. While malingerers do exist their numbers among personal injury claimants is not high (McKinley, Brooks, and Bond, 1983; McKinley and Kilforder, 1992; Repko and Cooper, 1983). Thus, within a large sample, as in this study, their responses are not expected to significantly alter mean scores and findings likely represent the non-malingering litigious HI population. Additional support for this assumption may be found in the close resemblance between the findings of this study and previous HI and CP research using non-litigious populations.

2. The elimination criteria used in this study were among the more conservative ones used in HI research. Most exaggerated profiles likely were eliminated from the study, reducing the possibility of malingering in the remaining profiles.
The cluster analysis presented in this study offers additional support for this assumption. Sternbach (1974) and McCrea (1985) described MMPI patterns they called "manipulative" suggesting a malingering response. Similar MMPI-2 patterns were not identified in the current study. Chronic pain literature also suggests a "litigation profile" showing MMPI elevations on scales Hs, D, and Hy (Sternbach et al. 1973b). The validity of this pattern as an indication of malingering is questionable because similar MMPI patterns are often found for non-litigious CP individuals (Keller and Butcher, 1991) as well as in cases where a claim was settled (Levy, 1992). The neurotic-triad pattern, while common in this study (36% of men and 21% of women), was not the only one found. Although a large proportion of the sample showed average profiles, one would be hard pressed to claim the rest are exaggerating their symptoms. Further longitudinal research comparing litigious and non-litigious HI samples are needed to assess the effect of litigation and claim settlement on MMPI-2 profiles.

3. Though relatively conservative, the elimination criteria for the validity scales used in this study allowed for profiles with F scale T-scores over 90 to be included. While such scores are considerably elevated, and may suggest symptom exaggeration, it is important to note the premise of this study is that elevated scores are not always what they
seem to be. F scale elevations may be the result of the endorsement of true somatic complaints or, alternatively, a cry for help in cases of actual emotional distress (Graham, 1990). Psychologists should be extremely cautious in interpreting elevated F scale scores as an attempt to augment complaints when the interpretation signifies the difference between granting additional support (which may be desperately needed) and an attitude of resentful contempt and withdrawal of support by insurance agencies (McKinley and Kilfedder, 1992).

4. Caution is required not only in the case of symptom exaggeration. Shaffer, Nussbaum, and Little (1972) pointed out that many HI individuals tend to deny and minimize their symptoms either as a result of lack of awareness or in denial of distressing reality. Perusal of subgroup profiles found in this study (figures 1 and 2) indicates defensive patterns (F scale score lower than L and K scale scores) are present for both men and women. This pattern may represent minimization or denial. Further research is required to investigate the relationship between this score configuration and attitude to injury, and to evaluate its significance in the treatment of HI individuals.

5. The purpose of this study was to suggest a correction factor for the MMPI-2 which will reduce profile distortion
resulting from the endorsement of somatic complaints. Two
correction factors were suggested (for HI and CP related
items). As noted above, the validity and reliability of
these correction factors should be assessed in a similar HI
sample before more accurate predictions can be made
regarding residual profile elevations.

6. Following the validation of the suggested correction
factors and identified MMPI-2 pattern subgroups further
research is recommended to evaluate the relationship between
MMPI-2 profiles and treatment outcome.
References


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Appendix A
The Minnesota Multiphasic Personality Inventory (MMPI)

A. Description of MMPI Validity Scales.

1. Cannot Say scale (?). Number of unanswered/doubly answered items.

2. L Scale. Tendency to present overly favorable, virtuous self-image.

3. F Scale. Tendency to endorse rare, unusual items reflecting disturbance, confusion, exaggeration, disorganization, or faking.


B. Description of MMPI Clinical Scales.

Scale 1. Hypochondriasis (Hs). "Hypochondriasis." Tendency to claim many vague somatic problems, unhappy, complaining, demanding, hostile.

Scale 2. Depression (D). Pessimism, despondency, guilt, low self-esteem, and vegetative symptoms.


Scale 4. Psychopathic Deviate (Pd). Impulsiveness, hostility, disregard for rules and authority, extroverted, manipulative, exhibitionistic, poor insight or empathy.


Scale 7. Psychasthenia (Pt). Anxiety, phobic preoccupations, tendency to intellectualize, obsessiveness, compulsiveness.

Scale 8. Schizophrenia (Sc). Unconventionality, unusual ideas and experiences, social alienation, confusion, psychosis.

Scale 0. Social Introversion (Si). Overcontrol, shyness, tension, guilt, withdrawal, social inadequacy.

C. Description of MMPI Content Scales (Wiggins).
The following description was adapted from: Wiggins, J. (1980). Content dimensions in the MMPI. In Dahlstrom, W.G., & Dahlstrom, L. (Eds.). Basic Readings on the MMPI. (pp. 300-327).

1. Social Maladjustment (SOC): High SOC is socially bashful, shy, embarrassed, reticent, self-conscious, and extremely reserved. Low SOC is gregarious, confident, assertive and relates quickly and easily to others. He is fun-loving, the life of a party, a joiner who experiences no difficulty in speaking before a group. This scale would correspond roughly with the popular concept of "introversion-extraversion."

2. Depression (DEP): High DEP experiences guilt, regret, worry, unhappiness, and a feeling that life has lost its zest. He experiences difficulty in concentrating and has little motivation to pursue things. His self-esteem is low, and he is anxious and apprehensive about the future. He is sensitive to slight, feels misunderstood, and is convinced that he is unworthy and deserves punishment. In short, he is classically depressed.

3. Feminine Interests (FEM): High FEM admits to liking feminine games, hobbies, and vocations. He denies liking masculine games, hobbies, and vocations. Here there is almost complete contamination of content and form, which has been noted in other contexts by several writers. Individuals may score high on this scale by presenting themselves as liking many things, since this item stem is present in almost all items. They may also score high by endorsing interests that, although possibly feminine, are also socially desirable, such as an interest in poetry, dramatics, news of the theater, and artistic pursuits. Finally, of course, individuals with a genuine preference for activities that are conceived by our culture as "feminine" will achieve high scores on this scale.

4. Poor Morale (MOR): High MOR is lacking in self-confidence, feels that he has failed in life, and is given to despair and a tendency to give up hope. He is extremely sensitive to the feelings and reactions of others and feels misunderstood by them, while at the same time being
concerned about offending them. He feels useless and is socially suggestible. There is a substantive overlap here between the Depression and Social Maladjustment scales and the Poor Morale scale. The Social Maladjustment scale seems to emphasize a lack of social ascendance and poise, the Depression scale, feelings of guilt and apprehension, while the present scale seems to emphasize a lack of self-confidence and hypersensitivity to the opinions of others.

5. Religious Fundamentalism (REL): High scores on this scale see themselves as religious, churchgoing people who accept as true a number of fundamentalist religious convictions. They also tend to view their faith as the true one.

6. Authority Conflict (AUT): High AUT sees life as a jungle and is convinced that others are unscrupulous, dishonest, hypocritical, and motivated only by personal profit. He distrusts others, has little respect for experts, is competitive, and believes that everyone should get away with whatever they can.

7. Psychoticism (PSY): High PSY admits to a number of classic psychotic symptoms of a primarily paranoid nature. He admits to hallucinations, strange experiences, loss of control, and classic paranoid delusions of grandeur and persecution. He admits to feelings of unreality, daydreaming, and sense that things are wrong, while feeling misunderstood by others.

8. Organic Symptoms (ORG): High ORG admits to symptoms that are often indicative of organic involvement. These include headaches, nausea, dizziness, loss of motility and coordination, loss of consciousness, poor concentration and memory, speaking and reading difficulty, poor muscular control, tingling skin sensations, and disturbances in hearing and smelling.

9. Family Problems (FAM): High FAM feels that he had an unpleasant home life characterized by a lack of love in the family and parents who were unnecessarily critical, nervous, quarrel some, and quick tempered. Although some items are ambiguous, most are phrased with reference to the parental home rather than the individual’s current home.

10. Manifest Hostility (HOS): High HOS admits to sadistic impulses and a tendency to be cross, grouch, competitive, argumentive, uncooperative, and retaliatory in his interpersonal relationships. He is often competitive and socially aggressive.
11. **Phobias (PHO):** High PHO has admitted to number of fears, many of them of classically phobic variety such as heights, darkness, and closed spaces.

12. **Hypomania (HYP):** High HYP is characterized by feelings of excitement, well being, restlessness, and tension. He is enthusiastic, high strung, cheerful, full of energy, and apt to be hot headed. He has broad interests, seeks change, and is apt to take on more than he can handle.

13. **Poor Health (HEA):** High HEA is concerned about his health and has admitted to a variety of gastrointestinal complaints centering around an upset stomach and difficulty in elimination.
Appendix B
The Minnesota Multiphasic Personality Inventory-2 (MMPI-2)

A. Description of Additional Validity Scales.

The following description was adapted from Butcher, J.N., & Pope, K.S. (1992). The research base Psychometric properties, and clinical uses of the MMPI-2 and MMPI-A. Canadian Psychology, 33, 61-78.

**Fb Scale.** A measure of symptom exaggeration (much like the F Scale) for items toward the end of the item pool.

**True Response Inconsistency (TRIN).** A measure of response inconsistency using pairs of statements which are opposite in content. Assesses tendency for set responses (all true or all false).

**Variable Response Inconsistency (VRIN).** A measure of response inconsistency using pairs of statements with either similar or opposite content. Assesses random responding.

B. Description of the MMPI-2 Content Scales.


1. **Anxiety (ANX, 23 items):** High scorers on ANX report general symptoms of anxiety, including tension, somatic problems (i.e., heart pounding and shortness of breath), sleep difficulties, worries, and poor concentration. They fear losing their minds, find life a strain, and have difficulties making decisions. They appear to be readily aware of these symptoms and problems, and are willing to admit to them.

2. **Fears (FRS, 23 items):** A high score on FRS indicates an individual with many specific fears. These specific fears can include blood; high places; money; animals such as snakes, mice, or spiders; leaving home; fire; storms and natural disasters; water; the dark; being indoors; and dirt.

3. **Obsessiveness (OBS, 16 items):** High scorers on OBS have tremendous difficulties making decisions and are likely to ruminate excessively about issues and problems, causing others to become impatient. Having to make changes distresses them, and they may report some compulsive behaviors like counting or saving unimportant things. They are excessive worriers who frequently become overwhelmed by
their own thoughts.

4. Depression (DEP, 33 items): High scores on this scale characterize individuals with significant depressive thoughts. They report feeling blue, uncertain about their future, and uninterested in their lives. They are likely to brood, be unhappy, cry easily, and feel hopeless and empty. They may report thoughts of suicide or wishes that they were dead. They may believe that they are condemned or have committed unpardonable sins. Other people may not be viewed as a source of support.

5. Health Concerns (HEA, 36 items): Individuals with high scores on HEA report many physical symptoms across several body systems. Included are gastrointestinal symptoms (e.g., constipation, nausea and vomiting, stomach trouble), neurological problems (e.g., convulsions, dizziness and fainting spells, paralysis), sensory problems (e.g., poor hearing or eyesight), cardiovascular symptoms (e.g., heart or chest pains), skin problems, pain (e.g., headaches, neck pains), respiratory troubles (e.g., coughs, hay fever, or asthma). These individuals worry about their health and feel sicker than the average person.

6. Bizarre Mentation (BIZ, 24 items): Psychotic thought processes characterize individuals high on the BIZ scale. They may report auditory, visual or olfactory hallucinations and may recognize that their thoughts are strange or peculiar. Paranoid ideation (e.g., the belief that they are being plotted against or that someone is trying to poison them) may be reported as well. These individuals may feel that they have a special mission or special powers.

7. Anger (ANG, 16 items): High scores on the ANG scale suggest anger control problems. These individuals report being irritable, grouchy, impatient, hot headed, annoyed, and stubborn. They sometimes feel like swearing or smashing things. They may lose self control and report having been physically abusive toward people and objects.

8. Cynicism (CYN, 23 items): Misanthropic beliefs characterize high scorers on CYN. They expect hidden, negative motives behind the acts of others; for example, believing that most people are honest simply for fear of being caught. Other people are to be distrusted, for people use each other and are only friendly for selfish reasons. They likely hold negative attitudes about those close to them, including fellow workers, family, and friends.

9. Antisocial Practices (ASP, 22 items): In addition to holding similar misanthropic attitudes to high scorers on the CYN scale, high scorers on the ASP scale report problem
behaviors during their school years and other antisocial practices like being in trouble with the law, stealing, or shoplifting. They report that they sometimes enjoy the antics of criminals and believe that it is all right to get around the law, as long as it is not broken.

10. Type A (TPA, 19 items): High scorers on TPA are hard driving, fast moving, and work oriented individuals, who frequently become impatient, irritable, and annoyed. They do not like to wait or be interrupted. There is never enough time in a day for them to complete their tasks. They are direct and may be overbearing in their relationships with others.

11. Low Self Esteem (LSE, 24 items): High scores on LSE characterize individuals with low opinions of themselves. They do not believe that they are liked by others or that they are important. They hold many negative attitudes about themselves including beliefs that they are unattractive, awkward, and clumsy, useless, and a burden to others. They certainly lack self confidence, and find it hard to accept compliments from others. They may be overwhelmed by all the faults they see in themselves.

12. Social Discomfort (SOD, 24 items): SOD high scorers are very uneasy around others, preferring to be by themselves. When in social situations, they are likely to sit alone, rather than joining in the group. They see themselves as shy and dislike parties and other group events.

13. Family Problems (FAM, 25 items): Considerable family discord is reported by high scorers on FAM. Their families are described as lacking in love, quarreling, and unpleasant. They even may report hating members of their families. Their childhood may be portrayed as abusive, and marriages seen as unhappy and lacking in affection.

14. Negative Work Attitudes (WRK, 33 items): A high score on the WRK is indicative of behaviors or attitudes likely to contribute to poor work performance. Some of the problems relate to low self confidence, concentration difficulties, obsessiveness, tension and pressure, and decision making problems. Others suggest lack of family support for the career choice, personal questioning of career choice, and negative attitudes toward co-workers.

15. Negative Treatment Indicators (TRT, 26 items): High scores on TRT indicate individuals with negative attitudes toward doctors and mental health treatment. High scorers do not believe that anyone can understand or help them. They have issues or problems that they are not comfortable
discussing with anyone. They may not want to change anything in their lives, nor do they feel that change is possible. They prefer giving up rather than facing a crisis or difficulty.

C. Description of the Harris-Lingoes Subscales for the MMPI-2.

The following description was adapted from: Butcher, J.N. (1990). The MMPI-2 in Psychological Treatment. New York: Oxford University Press.

Scale 1. Hypochondriasis: None.

Scale 2. Depression:

D1-Subjective Depression (32 items)
High scores suggest: feeling depressed, unhappy, nervous; lacks energy and interest; not coping well; problems in concentration and attention; feels inferior; lacks self confidence; shy and uneasy in social situations.

D2- Psychomotor Retardation (14 items)
High scores suggest: immobilized, withdrawn; lacks energy; avoids people; denies hostility.

D3- Physical Malfunctioning (11 items)
High scores suggest: preoccupied with physical functioning; denies good health; wide variety of somatic complaints.

D4- Mental Dullness (15 items)
High scores suggest: lacks energy; feels tense; has problems in concentration and attention; lacks self confidence; feels life is not worthwhile.

D5- Brooding (10 items)
High scores suggest: broods, ruminates; lacks energy; feels inferior; feels life is not worth living; easily hurt by criticism; feels like losing control of thought processes.

Scale 3. Hysteria:

H1- Denial of Social Anxiety (6 items)
High scores suggest: socially extroverted and comfortable; not easily influenced by social standards and customs.
Hy2- Need for Affection (12 items)
High scores suggest: strong needs for attention and affection; sensitive, optimistic, trusting; avoids confrontations; denies negative feelings toward others.

Hy3- Lassitude-Malaise (15 items)
High scores suggest: uncomfortable and not in good health; tired, weak, fatigue; problems in concentration; poor appetite; sleep disturbance; unhappy.

Hy4- Somatic Complaints (17 items)
High scores suggest: multiple somatic complaints; utilizes repression and conversion of affect; little or no hostility expressed.

Hy5- Inhibition of Aggression (7 items)
High scores suggest: denies hostile and aggressive impulses; sensitive about response of others.

Scale 4. Psychopathic Deviate:

Pd1- Familial Discord (9 items)
High scores suggest: views home situation as unpleasant and lacking in love, support, understanding; family critical and controlling.

Pd2- Authority Problems (8 items)
High scores suggest: resents authority; trouble in school and with law; definite opinions about right and wrong; stands up for beliefs.

Pd3- Social Imperturbability (6 items)
High scores suggest: comfortable and confident in social situations; exhibitionistic; defends opinions.

Pd4- Social Alienation (13 items)
High scores suggest: feels misunderstood, alienated, isolated, estranged; lonely, unhappy, uninvolved; blames others; self centered, insensitive, inconsiderate; verbalizes regret and remorse.

Pd5- Self Alienation (12 items)
High scores suggest: uncomfortable, unhappy; problems in concentration; life not interesting or rewarding; hard to settle down; excessive use of alcohol.

Scale 5. Masculinity-Femininity:
An attempt to develop subscales for the Mf scale was unsuccessful because of the lack of enough homogeneous subsets of Mf items to produce psychometrically sound
scales.

**Scale 6. Paranoia:**

**Pa1- Persecutory Ideas (17 items)**
High scores suggest: views world as threatening; feels misunderstood, unfairly blamed or punished; suspicious, untrusting; blames others; sometimes delusions of persecution.

**Pa2- Poignancy (9 items)**
High scores suggest: sees self as high strung, sensitive, feeling more intensely than others; feels lonely, misunderstood; looks for risk and excitement.

**Pa3- Naivete (9 items)**
High scores suggest: extremely naive and optimistic attitudes toward others; trusting; high moral standards; denies hostility.

**Scale 7. Psychasthenia:** None.

**SCALE 8. Schizophrenia:**

**Sc1- Social Alienation (21 items)**
High scores suggest: feels misunderstood, mistreated, family situation lacking in love and support; lonely, empty; hostility, hatred toward family; never experience love relationship.

**Sc2- Emotional Alienation (11 items)**
High score suggest: depression, despair; wishes he or she were dead; frightened, apathetic.

**Sc3- Lack of Ego Mastery, Cognitive 10 items)**
High scores suggest: fears losing mind; strange thought processes; feelings of unreality; problems with concentration, attention.

**Sc4- Lack of Ego Mastery, Conative (14 items)**
High scores suggest: feels life is a strain; depression, despair; worries; problems coping with everyday problems; life not interesting, rewarding; given up hope; may wish he or she were dead.

**Sc5- Lack of Ego Mastery, Defective Inhibition (11 items)**
High scores suggest: feels out of control of emotions, impulses; restless, hyperactive, irritable; laughing or crying episodes; may not remember previously performed activities.
Scale 6. Bizarre Sensory Experiences (20 items)
High scores suggest: feels body changing in unusual ways; hallucinations, unusual thoughts, external reference; skin sensitivity, weakness, ringing in ears, etc.

Scale 9. Hypomania:
Ma1- Amorality 6 items)
High scores suggest: sees others as selfish; dishonest and feels justified in being this way; derives vicarious satisfaction from manipulative exploits of others.

Ma2- Psychomotor Acceleration 11 items)
High scores suggest: accelerated speech, thought processes, motor activity; tense, restless; feels excited, elated without cause; easily bored; seeks out excitement; impulse to do harmful or shocking things.

Ma3- Imperturbability (8 items)
High scores suggest: denies social anxiety; not especially sensitive about what others think; impatient, irritable toward others.

Ma4- Ego Inflation (9 items)
High scores suggest: unrealistic self appraisal; resentful of demands made by others.

Scale 0. Social Introversion:
Si1- Shyness
High scorers feel shy around others, feel easily embarrassed, feel ill at ease in social situations, and feel uncomfortable as the enter new situations.

Si2- Social Avoidance
High scores on the subscale reflect a great dislike of group activities, concerns about group participation, active efforts to avoid being in a crowd, dislike of parties and social events, and a strong aversion to interpersonal contacts. Individuals with high Si2 subscale scores are likely to report considerable difficulty with other people and with entering social or group situations.

Si3- Self Other Alienation
High scores on this subscale reflect characterological personality traits that make the individual vulnerable to failure in social interactions. High scores reflect low self esteem, low self confidence, self critical
tendencies, self doubt about personal judgment, and feeling of being ineffective at determining one's own fate. High scores also reflect nervousness, fearfulness, and indecisiveness.

D. Description of MMPI-2 Supplemental Scales.

Anxiety (A) - Individuals scoring high on this scale are viewed as anxious, tense, obsessional, and generally maladjusted.

Repression (R) - Individuals scoring high on this scale tend to be overcontrolled. They deny problems and tend to gloss over personal frailties. They are seen as constricted and inhibited.

Ego Strength (Es) - This scale assesses the ability of the individual to tolerate stress and to benefit from treatment.

Overcontrolled Hostility (O-H) - This scale assesses the personality style of overcontrolled hostility or the possibility that the individual represses conflict to the extent that explosive behavior could occur.

Dominance (Do) - This scale measures the extent to which the individual is dominant in social and interpersonal contexts.

Responsibility (Re) - This scale addresses the extent to which the individual holds attitudes of social responsibility.

College Maladjustment (MT) - Scores on the Mt scale are useful in identifying existing emotional problems among college students but not very useful in predicting future adjustment difficulties.

Higher scorers on the Mt scale are likely to be generally poorly adjusted, ineffectual, pessimistic, and anxious. Low scorers on Mt tend to be well adjusted, optimistic, and conscientious.

Gender-Role Scales (GM and GF) - For male subjects the GM scale is related to high self-confidence, strong persistence, and wide interests, as well as a lack of fears or feelings of self-reference. For females, GM is also related to high self-confidence, as well as honesty and a willingness to try new things and with a lack of worries or feelings of self-reference.
Similarly, for male subjects the GF scale is related to religiosity, avoidance of swearing or cursing, and frankness in pointing out to others their personal faults. This scale is also correlated with bossiness, poor control over one’s own temper, as well as susceptibility to the abuse of alcohol and non-prescription drugs. For females, GF is also related to religiosity and problems with alcohol and non-prescription drugs.

**Keane Posttraumatic Stress Disorder (PK)** - This scale assesses the symptoms of the syndrome of post-traumatic stress disorder.

**Post Traumatic Stress Disorder Scale (PS)** - A second scale was developed by contrasting emotionally healthy Vietnam-era veterans with those identified as showing primarily post-traumatic-stress disorder without other psychiatric involvement. The two PTSD scales appear to be largely independent of each other; both may be used conjointly for better diagnostic classification.

**MacAndrew Scale-Revised (MAC-R)** - High scorers have been found to be prone to developing problems of addiction such as alcohol or drug abuse, pathological gambling, or other addictive problems.
Appendix C

Items unique to HZ for both men and women

1. (31) I find it hard to keep my mind on a task or job. (T)
2. (35) Sometimes when I was young I stole things. (T)
3. (53) Parts of my body often have feelings like burning, tingling, crawling, or like "going to sleep." (T)
4. (69) I think I would like the kind of work a forest ranger does. (F)
5. (91) I have little or no trouble with my muscles twitching or jumping. (F)
6. (106) My speech is the same as always (not faster or slower, no slurring or hoarseness). (F)
7. (119) I like collecting flowers or growing house plants. (T)
8. (137) I used to keep a diary. (T)
9. (146) I cry easily. (T)
10. (147) I cannot understand what I read as well as I used to. (T)
11. (168) I have had periods in which I carried on activities without knowing later what I had been doing. (T)
12. (180) There is something wrong with my mind. (T)
13. (229) I have had blank spells in which my activities were interrupted and I did not know what was going on around me. (T)
14. (266) I have never been in trouble with the law. (F)
15. (299) I cannot keep my mind on one thing. (T)
16. (308) I forget right away what people say to me. (T)
17. (309) I usually have to stop and think before I act even in small matters. (T)
18. (325) I have more trouble concentrating than others seem to have. (T)
Appendix D
Correction factor for MMPI-2 (comparison of HI and the MS)

1. (2) I have a good appetite.
2. (9) My daily life is full of things that keep me interested.
3. (22) No one seems to understand me.
4. (31) I find it hard to keep my mind on a task or job. *
5. (33) I seldom worry about my health.
6. (38) I have had periods of days, weeks, or months when I couldn't take care of things because I couldn't "get going." #
7. (39) My sleep is fitful and disturbed.
8. (40) Much of the time my head seems to hurt all over.
9. (45) My judgment is better than it ever was.
10. (49) I am a very sociable person.
11. (53) Parts of my body often have feelings like burning, tingling, crawling, or like "going to sleep". #
12. (73) I am certainly lacking in self-confidence.
13. (91) I have little or no trouble with my muscles twitching or jumping.
14. (101) Often I feel as if there is a tight band around my head. +
15. (106) My speech is the same as always (not faster or slower, no slurring or hoarseness). *
16. (109) I seem to be about as capable and smart as most others around me.
17. (130) I certainly feel useless at times.
18. (140) Most nights I go to sleep without thoughts or ideas bothering me.
19. (141) During the past few years I have been well most of the time.
20. (146) I cry easily. #

21. (147) I cannot understand what I read as well as I used to. #

22. (149) The top of my head sometimes feels tender. *

23. (164) I seldom or never have dizzy spells. #

24. (168) I have had period in which I carried on activities without knowing later what I had been doing. #

25. (172) I frequently notice my hand shakes when I try to do something. +

26. (173) I can read a long while without tiring my eyes.

27. (175) I feel weak all over much of the time. +

28. (177) My hands have not become clumsy or awkward. #

29. (179) I have had no difficulty in keeping my balance in walking. *

30. (180) There is something wrong with my mind. *

31. (218) I have periods of such great restlessness that I cannot sit long in a chair.

32. (229) I have had blank spells in which my activities were interrupted and I did not know what was going on around me.

33. (247) I have numbness in one or more places on my skin.*

34. (255) I do not often notice my ears ringing or buzzing.

35. (273) Life is a strain for me much of the time.

36. (295) I have never been paralysed or had any unusual weakness of any of my muscles. *

37. (296) Sometimes my voice leaves me or changes even though I have no cold.

38. (299) I cannot keep my mind on one thing. #

39. (308) I forget right away what people say to me.

40. (309) I usually have to stop and think before I act even in small matters.
41. (325) I have more trouble concentrating than others seem to have. *

42. (330) At times I am all full of energy.

# - Appears on Alfano et al.'s (1990) correction factor.
* - Appears on both correction factors.
## Appendix E

Sample size and endorsement frequency (EF) for the NS, CP, and HI groups.

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**Note.** # - Item number.
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I2 - "True" EF in N2
N3 - Male head injury sample size
I3 - "True" EF in N3
N4 - Female Normative Sample size
I4 - "True" EF in N4
N5 - Female chronic pain sample size
I5 - "True" EF in N5
N6 - Female head injury sample size
I6 - "True" EF in N6
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141
Comparison of item lists from Gass (1991) Alfano et al. (1993) and the current study.

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<tr>
<td>1. (10)</td>
<td>I am about as able to work as I ever was.</td>
<td>X</td>
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<td>2. (12)</td>
<td>My sex life is satisfactory.</td>
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<td>3. (23)</td>
<td>At times I have fits of laughing and crying that I cannot control.</td>
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<td>4. (31)</td>
<td>I find it hard to keep my mind on a task or job.</td>
<td>X</td>
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<td>5. (32)</td>
<td>I have had very strange and peculiar experiences.</td>
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<td>6. (35)</td>
<td>Sometimes when I was young I stole things.</td>
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<td>7. (37)</td>
<td>At times I feel like smashing things.</td>
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<td>8. (38)</td>
<td>I have had periods of days, weeks or months when I couldn't take care of things because I couldn't get going.</td>
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<td>9. (53)</td>
<td>Parts of my body often have had feelings like burning, twitching, crawling, or like &quot;going to sleep&quot;.</td>
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<td>10. (69)</td>
<td>I think I would like the kind of work a forest ranger does.</td>
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<td>11. (91)</td>
<td>I have little or no trouble with my muscles twitching or jumping.</td>
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<td>12. (101)</td>
<td>Often I feel as though there were a tight band about my head.</td>
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13. I'm always (not faster or slower, no slurring or hoarseness).

14. I like collecting flowers or growing house plants.

15. I used to keep a diary.

16. I cry easily.

17. I cannot understand what I read as well as I used to.

18. The top of my head sometimes feels tender.

19. I have never had a fainting spell.

20. I seldom or never have dizzy spells.

21. My memory seems to be alright.

22. I have had periods in which I carried on activities without knowing later what I had been doing.

23. I am afraid of losing my mind.

24. I frequently notice that my hand shakes when I try to do something.

25. I feel weak all over much of the time.

26. I have very few headaches.

27. My hands have not become clumsy or awkward.

28. I have had no difficulty in walking or keeping my balance.

29. There is something wrong with my mind.

30. I have had blank spells in which my activities were...
interrupted and I did not know what was going on around me.

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<td>31.241</td>
<td>It is safer to trust nobody.</td>
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<td>32.247</td>
<td>I have numbness in one or more regions of my skin.</td>
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<td>33.266</td>
<td>I have never been in trouble with the law.</td>
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<td>34.295</td>
<td>I have never been paralyzed or had any unusual weakness of any of my muscles.</td>
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<td>35.299</td>
<td>I cannot keep my mind on one thing.</td>
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<td>36.307</td>
<td>I feel anxiety about something or someone almost all of the time.</td>
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<td>37.308</td>
<td>I forget right away what people say to me.</td>
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<td>38.309</td>
<td>I usually have to stop and think before I act even in small matters.</td>
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<td>I have had periods in which I carried on activities without knowing later what I had been doing.</td>
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CURRICULUM VITAE

GALIA ARTZY
#408-2646 COOK STREET
VICTORIA, B.C. V8T3S1
CANADA
Home: (604) 382-8323

PERSONAL BACKGROUND:
Date of Birth: April 13, 1960
Citizenship: Israel.

MILITARY SERVICE:
1978-1980 Intelligence Sergeant

EDUCATION:
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University, Jerusalem.
University, Jerusalem.

PROFESSIONAL AFFILIATIONS:
American Psychological Association (APA)
International Neuropsychological Society (INS)

CLINICAL EXPERIENCE:
FELLOWSHIP
1991-1992 Neurobehavior and Alzheimer’s
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Medical Center, New-York.

INTERNERSHIP
1990-1991 Hahnemann University Pre-Doctoral
Internship, Philadelphia.
1986-1987 Department of Psychiatry, Shaare
Zedek Medical Center, Jerusalem.
1985-1986 Department of Psychiatry, Shaare
Zedek Medical Center, Jerusalem.
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<td>1985-1986</td>
<td>Consulting Diagnostician for a NIH research of Alzheimer’s Disease and Research Coordinator for Shaare Zedek Medical Center in a Ministry of Health Patient Survey. Teaching Assistant, Hebrew University, Jerusalem.</td>
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<td>1984-1985</td>
<td>Teaching Assistant, Hebrew University Jerusalem.</td>
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<td>1983-1984</td>
<td>Head of Research Team, directed by Dr. M. Rosenthal, Department of Education, Hebrew University, Jerusalem.</td>
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<td>1982-1983</td>
<td>Head of Research Team, directed by Prof. Z.C. Greenbaum, Department of Psychology, Hebrew University, Jerusalem.</td>
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<td>1981-1982</td>
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Author: ____________________________
          (signature)

Ms Galia Artzy____________________
          (name)

December 20, 1994
          (date)