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

by

Galia Artzy

B.A., Hebrew University, Jerusalem
M.A., Hebrew University, Jerusalem

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

in the Department of Psychology

We accept this dissertation as conforming to the required standard

---

Dr. F. Spellacy, Supervisor
(Department of Psychology)

Dr. E. Strauss, Departmental Member
(Department of Psychology)

Dr. P. Duncan, Departmental Member
(Department of Psychology)

Dr. K. Berthiaume, Outside Member
(Department of Anthropology)

Dr. L. I. Cripe, External Examiner
(Clinical Neuropsychologist)

University of Victoria

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.

Examiners:

Dr. F. Spellacy, Supervisor
(Department of Psychology)

Dr. E. Strauss, Departmental Member
(Department of Psychology)

Dr. P. Duncan, Departmental Member
(Department of Psychology)

Dr. K. Berthiaume, Outside Member
(Department of Anthropology)

Dr. L. I. Cripe , External Member
(Clinical Neuropsychologist)

Table of Contents

List of Tables

List of Figures

Acknowledgements

The endorsement and support of this project by Frank Spellacy and Associates is gratefully acknowledged. The author is thankful to members of her doctoral committee chaired by Dr. F. Spellacy for their review and suggestions. The author thanks Ms. Liping Zhang and Mr. Ralph Gabriel for their assistance in computer data management and statistical analysis. A special thanks to Ms. Jennifer Cowan and Ms. Sharon Brown for their patience and support.

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 responsiblity 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 then 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 (Crine 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 concidered 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 <u>reactions</u> 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

the MMPI.

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, especiallly 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 (1993) 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 (Strassberg, Reimherr, Ward, Russell, and Cole, 1981). 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

al.'s.

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 1
Age distribution in male and female HI samples

Age group	MHI		FHI	
	N	percent	N	percent
18 - 19	10	10.0%	8	11.1%
20 - 29	37	37.0%	23	31.9%
30 - 39	23	23.0%	20	27.8%
40 - 49	19	19.0%	11	15.3%
50 - 59	6	6.0%	4	5.6%
60 - 69	3	3.0%	5	6.9%
70 - 79	2	2.0%	1	1.4%
	100	100.0%	72	100.0%

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
Education distribution in men and women with HI

Education level	MHI		FHI	
	N	percent	N	percent
Part High-School	40	40.0%	23	31.9%
High-School Grad.	29	29.0%	23	31.9%
College Grad.	21	21.0%	16	22.2%
Post Graduate educ.	10	10.0%	10	13.9%
	100	100.0%	72	100.0%

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 3
IQ data for men and women in the HI sample

	MHI Mean (Sd)	FHI Mean (SD)	F	P
Verbal IQ	100.11 (12.52)	97.50 (12.02)	1.881	.17
Performance IQ	100.87 (13.49)	101.54 (12.54)	0.111	.74
Full Scale IQ	100.36 (12.63)	98.57 (10.71)	0.953	.33

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

Marital status	MHI N	MHI percent	FHI N	FHI percent
Single	45	45.0%	27	37.5%
Married	36	36.0%	28	38.8%
Separated	5	5.0%	0	0.0%
Divorced	9	9.0%	9	12.5%
Common Law	5	5.0%	5	7.0%
Widow	0	0.0%	3	4.2%
	100	100.0%	72	100.0%

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

Race	MHI N	MHI percent	FHI N	FHI percent
Caucasian	98	98.0%	69	95.8%
Asian	2	2.0%	2	2.8%
Other	0	0.0%	1	1.4%
	100	100.0%	72	100.0%

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

Occupation	MHI N	MHI percent	FHI N	FHI percent
Unskilled worker	10	10.0%	11	15.3%
Semi-skilled worker	25	25.0%	14	19.5%
Student	15	15.0%	8	11.1%
Not in the work force	11	11.0%	12	16.6%
Skilled worker	19	19.0%	4	5.6%
Skilled White Collar	14	14.0%	16	22.2%
Professional	6	6.0%	7	9.7%
	100	100.0%	72	100.0%

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

	MHI		FHI	
	N	percent	N	percent
Nil	33	33.0%	37	51.4%
Less than 1 hr.	43	43.0%	23	31.9%
1-24 hours	8	8.0%	2	2.8%
1-7 days	9	9.0%	3	4.2%
More than 7 days	7	7.0%	7	9.7%
	100	100.0%	72	100.0%

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

	MHI		FHI	
	N	percent	N	percent
Nil	29	29.0%	30	41.6%
Less than 1 hr.	27	27.0%	21	29.2%
1-24 hours	16	16.0%	5	6.9%
1-7 days	10	10.0%	4	5.6%
More than 7 days	18	18.0%	12	16.7%
	100	100.0%	72	100.0%

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

Age group	MHI N	MHI percent	FHI N	FHI percent
Less than 20	22	22.0%	14	19.4%
20 - 30	27	27.0%	21	29.2%
30 - 40	29	29.0%	17	23.6%
40 - 50	11	11.0%	12	16.7%
50 - 60	7	7.0%	5	6.9%
60 - 70	3	3.0%	2	2.8%
70 - 80	1	1.0%	1	1.4%
	100	100.0%	72	100.0%

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

	MHI		FHI	
	N	percent	N	percent
6 months	4	4.0%	1	1.4%
6 mos - 1 yr	15	15.0%	11	15.2%
1 yr - 2 yrs	32	32.0%	22	30.6%
2 - 3 years	28	28.0%	23	31.8%
3 - 4 years	13	13.0%	11	15.2%
Over 4 yrs	8	8.0%	4	5.8%
	100	100.0%	72	100.0%

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

Variable	NS		CP	
Sex				
% Men (n)	44	(1138)	53	(268)
% Women (n)	56	(1462)	47	(234)
	Men	**Women**	**Men**	**Women**
Age				
Mean	41.7	40.5	39.8	40.3
S.D.	15.3	15.2	10.3	11.6
Range	18-84	17-85	18-74	19-76
Race				
% White	82.0	80.8	87.9	90.6
% Black	11.2	12.8	6.2	4.5
% Asian	0.5	0.9	0.4	0.4
% Other	6.4	5.5	5.5	4.5
Education (years)				
Mean	15.0	14.4	11.7	12.3
S.D.	2.8	2.4	2.2	2.1
Range	3-20	2-20	3-18	3-18
Marital status				
% Single	19.4	20.3	13.5	13.3
% Married	72.3	61.1	70.4	58.8
% Separated	2.0	2.3	4.1	3.0
% Divorced	5.2	11.0	11.6	21.9
% Widowed	1.1	5.3	0.4	3.0

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) wwere used to compare scale score distribtions 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 12
ANOVA: Validity and Main Clinical Scales by gender

Scale	Men	Women	F	P
	Score (SD)	Score (SD)		
Scale L	4.48 (2.29)	4.68 (2.11)	0.343	.56
Scale F	6.84 (3.78)	6.88 (4.45)	0.003	.95
Scale K	14.17 (5.28)	14.74 (5.31)	0.479	.49
Scale 1. Hs	**71.09 (13.86)**	**71.71 (12.23)**	0.092	.76
Scale 2. D	**70.30 (13.11)**	**69.53 (13.54)**	0.141	.71
Scale 3. Hy	**71.01 (14.18)**	**71.96 (15.12)**	0.177	.67
Scale 4. Pd	57.49 (11.50)	56.11 (11.23)	0.614	.44
Scale 5. Mf	49.74 (11.50)	50.85 (8.21)	0.557	.46
Scale 6. Pa	57.94 (14.63)	56.93 (13.08)	0.218	.64
Scale 7. Pt	**65.62 (12.74)**	**65.29 (11.75)**	0.030	.86
Scale 8. Sc	64.64 (13.84)	**66.07 (13.27)**	0.642	.50
Scale 9. Ma	52.35 (11.1)	52.92 (11.99)	0.102	.75
Scale 0. Si	55.72 (11.36)	55.11 (12.19)	0.113	.74

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 13
ANOVA: Additional Validity and Supplemental Scales by gender

Scale	Men		Women		F	P
	RS (SD)	TS	RS (SD)	TS		
F(b)	3.59(3.62)	57	4.18(4.45)	58	0.918	.34
TRIN	8.76(1.29)	50	8.92(1.44)	50	0.560	.46
VRIN	5.97(2.62)	54	5.49(2.51)	52	1.476	.23
A	15.69(8.85)	58	16.60(9.58)	57	0.411	.52
R	17.35(4.50)	54	19.54(4.18)	59	10.529	.001*
Es	30.56(6.35)	35#	28.04(5.77)	37#	7.108	.008*
O-H	13.39(3.08)	53	14.19(2.82)	52	3.060	.08
Do	13.47(3.19)	39#	13.00(3.17)	39#	0.915	.34
Re	18.24(4.47)	45	20.24(4.14)	47	8.885	.003*
Mt	20.19(7.99)	64	21.17(8.07)	62	0.621	.43
Gm	33.62(5.27)	41	26.33(5.80)	45	73.602	.000*
Gf	27.83(4.78)	51	37.03(4.11)	50	173.794	.000*
Pk	14.63(8.58)	61	14.64(8.95)	59	0.000	.995
Ps	22.33(11.7)	65	23.57(12.0)	63	0.459	.50
Mac-R	21.89(3.65)	51	19.26(4.33)	48	18.549	.000*

Note. * - Significant F, P<.05.

RS - Mean Raw Score
TS - Mean T-score
Bold print - Elevated T-score (> 65)
- Low T-score (< 40).

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

Scale	Men		Women		F	P
	RS(SD)	TS	RS(SD)	TS		
ANX	10.22(5.70)	60	11.13(5.29)	59	1.119	.29
FRS	3.80(2.66)	50	6.36(6.66)	49	28.279	.000*
OBS	6.26(3.72)	54	6.83(3.94)	53	0.947	.33
DEP	9.78(6.14)	61	9.93(6.77)	58	0.023	.88
HEA	13.51(6.88)	69	14.82(6.76)	68	1.539	.22
BIZ	3.13(3.12)	54	3.01(3.30)	56	0.055	.81
ANG	7.16(4.49)	53	6.75(3.73)	52	0.401	.53
CYN	9.34(5.12)	51	8.46(5.49)	49	1.169	.28
ASP	8.26(4.43)	48	5.82(3.78)	49	14.359	.000*
TPA	7.81(3.94)	59	7.51(3.78)	49	0.245	.62
LSE	6.85(4.82)	49	7.72(5.45)	55	1.220	.27
SOD	9.30(5.28)	60	9.40(5.98)	53	0.003	.96
FAM	5.98(3.93)	48	6.26(4.28)	50	0.407	.53
WRK	12.43(6.66)	60	13.32(6.57)	57	0.676	.41
TRT	7.32(4.91)	56	7.21(5.48)	55	0.021	.89

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 Ma1 (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 Ma1).

Both men and women showed elevated scores on subscales D1

(Subjective Depression), D3 (Physical Malfunctioning), D4 (Mental Dullness), Hy3 (Lassitude-Malaise), Hy4 (Somatic Complaints), Sc3 (Lack of Ego Mastery, Cognitive), and Sc6 (Bizarre Sensory Experience).

Table 15
ANOVA: Harris-Lingoes Subscales by gender

Subscale	Men RS (TS)	Women RS (TS)	F	P
D1	13.72 (68)	14.18 (65)	0.302	.58
D2	6.47 (49)	6.76 (56)	1.011	.32
D3	5.00 (67)	5.50 (67)	3.572	.06
D4	7.21 (84)	7.13 (71)	0.028	.87
D5	3.68 (60)	3.89 (57)	0.313	.58
Hy1	3.59 (48)	3.93 (51)	1.308	.25
Hy2	6.67 (50)	6.96 (50)	0.470	.49
Hy3	7.78 (74)	7.92 (71)	0.083	.77
Hy4	6.96 (72)	7.78 (68)	2.102	.15
Hy5	2.85 (47)	3.14 (47)	2.052	.15
Pd1	2.16 (52)	2.49 (53)	4.452	.25
Pd2	4.01 (55)	2.61 (52)	37.027	.000*
Pd3	3.65 (50)	3.54 (45)	0.155	.69
Pd4	4.93 (57)	4.74 (54)	0.312	.58
Pd5	4.94 (58)	4.71 (57)	0.346	.56
Pa1	2.44 (55)	2.46 (54)	0.003	.96
Pa2	3.19 (56)	3.26 (55)	0.065	.80
Pa3	5.06 (51)	5.14 (51)	0.061	.81
Sc1	3.34 (52)	4.03 (53)	2.220	.14
Sc2	1.72 (56)	1.72 (55)	0.000	.99
Sc3	4.84 (71)	5.03 (74)	0.224	.64
Sc4	4.73 (64)	4.81 (64)	0.034	.85
Sc5	2.19 (55)	2.47 (56)	0.915	.34
Sc6	6.14 (71)	6.75 (71)	1.006	.32
Ma1	2.25 (52)	1.58 (50)	12.440	.001*
Ma2	5.71 (52)	5.14 (51)	3.245	.07
Ma3	3.02 (47)	3.07 (50)	0.037	.85
Ma4	2.85 (49)	3.26 (51)	2.359	.13
Si1	5.77 (53)	5.93 (52)	0.078	.78
Si2	3.78 (53)	3.57 (54)	0.280	.60
Si3	6.68 (55)	6.72 (54)	0.004	.95

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 16
Scale distribution of items of different EF by men, women, and by both men and women with HI

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

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 C: 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

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

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

support.

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 lidts 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 questionner 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.

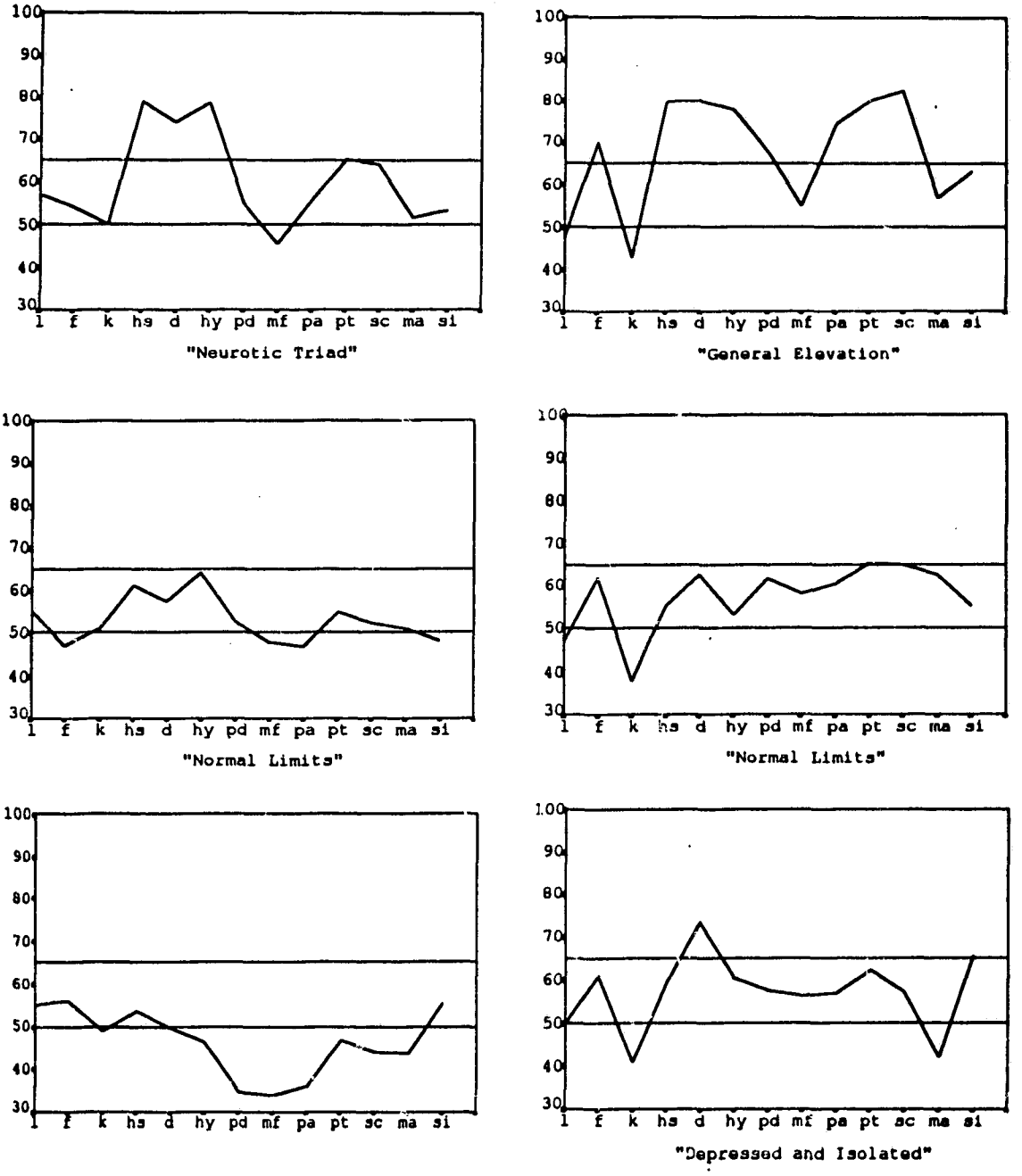
The current study, using the MMPI-2 with HI subjects, yielded scale elevations consistent with previous HI as well as CP research data. It was, therefore, hypothesized that cluster analysis of HI MMPI-2 profiles would yield pattern groups similar to those found for CP. As in the study of CP, the identification 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 scaled 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 refelect 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.

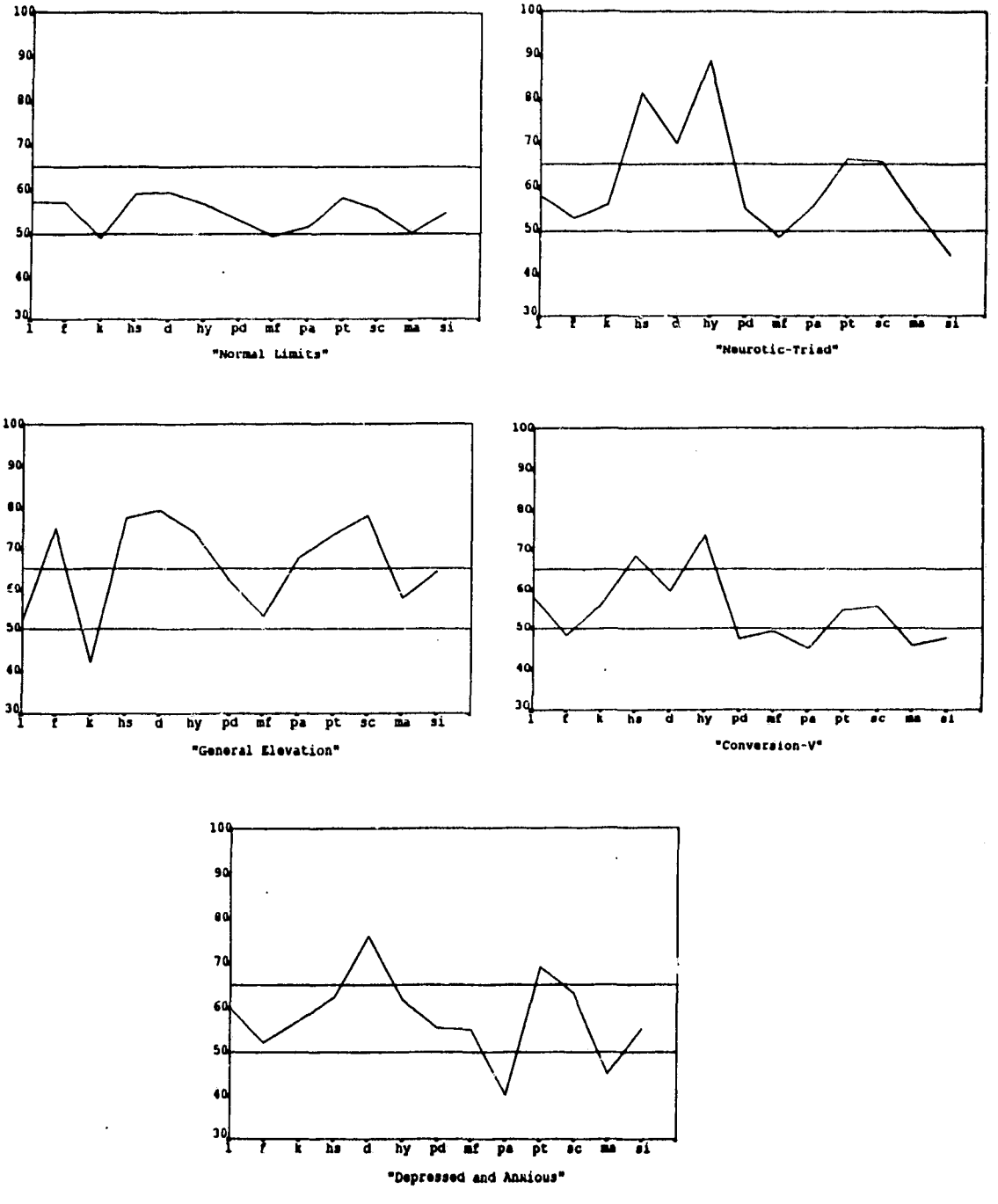
Of the five clusters identified for the women sample (N=72) four clusters showed elevated patterns and a fifth showed an average profile. The largest of the cluster groups (36% of the sample) showed a pattern similar to the general elevation profile found in men, with a sub-clinical elevation on scale 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 Kilfodder, 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 McCreary (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

Alfano, D.P., Finlayson, M.A.J., Stearns, G.M., & Neilson, P.M. (1990). The MMPI and neurologic dysfunction: Profile configuration and analysis. The Clinical Neuropsychologist, 4, 69-79.

Alfano, D.P., Neilson, P.M., Paniak, C.E., & Finlayson, M.A.J. (1992). The MMPI and closed head injury. The clinical Neuropsychologist, 6(2), 134-142.

Alfano, D.P., Paniak, C.E., & Finlayson, M.A.J. (1993). The MMPI and closed head injury. Neuropsychiatry, Neuropsychology, and Behavioral Neurology, 6(2), 111-116.

Armentrout, D.P., Moore, J.E., Parker, J.C., Hewett, J.E., & Feltz, C. (1982). Pain patient MMPI subgroups: the psychological dimensions of pain. Journal of Behavioral Medicine, 5, 201-211.

Barona, A., Reynolds, C.R., & Chastain, R. (1984). A demographically based index of premorbid intelligence for the WAIS-R. Journal of Consulting and Clinical Psychology, 52(5), 885-887.

Barron, F. (1953). An ego strength scale which predicts response to psychotherapy. Journal of Consulting Psychology, 17, 327-333.

Barth, J.T., Alves, W.M., Ryan, T.V., Macciocchi, S.N., Rimel, R.W., Jane, J.A., & Nelson, W.E. (1989). Mild head injury in sports: Neuropsychological sequelae and recovery in function. In H.S. Levin, H.M. Eisenberg, & A.L. Benton (Eds.), Mild Head Injury (pp. 257-275). New York: Oxford.

Ben-Porath, Y.S., & Butcher, J.N. (1989). Psychometric stability of rewritten MMPI items. Journal of Personality Assessment, 53(4), 645-653.

Bernstein, I.H., & Garbin, C.P. (1983). Hierarchical clustering of pain patients' MMPI profiles. Journal of Personality Assessment, 47, 171-172

Black, F.W. (1975). Unilateral brain lesions and MMPI performance: A preliminary study. The Journal of Nervous and Mental Disease, 175, 173-176.

Black, F.W., & Black, I.L. (1982). Anterior-posterior locus of lesion and personality: Support for the caudality hypothesis. Journal of Clinical Psychology, 38, 468-477.

Bornstein, R.A. (1984). Unilateral lesions and the Wechsler Adult Intelligence Scale-Revised: No sex differences. Journal of Consulting and Clinical Psychology, 52(4), 604-608.

Bradley, L.A., Prokop, C.K., Margolis, R., & Gentry, W.D. (1978). Multivariate analysis of the MMPI profiles of low back pain patients. Journal of Behavioral Medicine, 1, 253-272.

Bryden, M.P. (1982). Laterality: Functional Asymmetry in the Intact Brain. New York: Academic Press.

Burton, L.A., & Volpe, B.T. (1988). Sex differences in emotional status of traumatically brain injured patients. Journal of Neurologic Rehabilitation, 2(4), 151-157.

Butcher, J.N., Dahlstrom, W.G., Graham, J.R., Tellegen, A., & Kaemmer, B. (1989). Manual for the standardized Minnesota Multiphasic Personality Inventory: MMPI-2. Minneapolis: University of Minnesota Press.

Butcher, J.N., Graham, J.R., Williams, C.L., & Ben-Porath, Y.S. (1990). Development and Use of the MMPI-2 Content Scales. Minneapolis: University of Minnesota Press.

Butcher, J.N., and Harlow, T.C. (1987). Personality assessment in personal injury cases. In A. Hess, and I. Weiner (Eds.), Handbook of Forensic Psychology, (pp. 128-154). New York: Wiley.

Canter, A.H. (1951). MMPI profiles in multiple sclerosis. Journal of Consulting Psychology, 15, 253-256.

Cattell, R.B., & Eber, H.W. (1957). Handbook for the Sixteen Personality Factor Questionnaire (The Sixteen PF). Champaign, Illinois: Institute for Personality and Ability Testing.

Carter, L. (1994). The rising cost of traffic safety. Westworld, 20(3), 20-21.

Chelune, G.J., & Moehle, K.A. (1986). Neuropsychological assessment and everyday functioning. In D. Wedding, A.M. Horton, Jr., & J. Webster (Eds.), The Neuropsychology Handbook: Behavioral and Clinical Perspectives (pp.489 -525). New York: Springer.

Cripe, L.I. (1987). The Clinical Use of the MMPI with Neurologic Patients: A new perspective. Paper presented at the Army Medical Department Annual Psychology Conference, Seattle, WA.

Cripe, L.I. (1991). The MMPI in Neuropsychological Assessment: A murky, contaminated measure. Paper presented at University of Victoria Workshop, Victoria, B.C.

Cripe, L.I., & Dodrill, C.B. (1988). Neuropsychological test performance with chronic low-level formaldehyde exposure. The Clinical Neuropsychologist, 2(1), 41-48.

Cullum, C.M., & Bigler, E.D. (1987). Lateralized brain damage and the MMPI revisited. Paper presented at the Annual Meeting of the International Neuropsychological Society, Washington, DC.

Cullum, C.M., & Bigler, E.D. (1988). Short-form MMPI findings in patients with predominantly lateralized cerebral dysfunction. The Journal of Nervous and Mental Disease, 176(6), 332-342.

Dean, R.S., & Jacobson, B.P. (1982). MMPI characteristics for parents of emotionally disturbed and learning-disabled children. Journal of consulting and clinical psychology, 50(5), 775-777.

Dikmen, S., & Reitan, R.M. (1974). MMPI correlates of localized cerebral lesions. Perceptual and Motor Skills, 39, 831-840.

Dikmen, S., & Reitan, R.M. (1977). MMPi correlates of adaptive ability deficits in patients with brain lesions. Journal of Nervous and Mental Disease, 165, 247-254.

Dodge, G.R., & Kolstoe, R.H. (1971). The MMPI in differentiating early multiple sclerosis and conversion hysteria. Psychological Reports, 29, 155-159.

Duckworth, J.C. (1991). The Minnesota Multiphasic Personality Inventory-2: A review. Journal of Counseling and Development, 69, 564-567.

Edwards, A.L. (1959). Revised Manual of the Edwards Personal Preference Schedule. New York: Psychological Corporation.

Edwards, W.D., Morrison, T.L., & Weissman, H.N. (1993, August). The neurocorrected MMPI(NC-44): Suggestions for improving clinical and forensic evaluations. Paper presented at the 101 Annual Convention of the American Psychological Association, Toronto, Canada.

Edwards, W.D., Weissman, H.N., & Morrison, T.L. (1993, October). "Neuro-corrected items" on the MMPI-2: Endorsement rates in a psychiatric sample. Paper presented at the Annual Convention of the National Academy of Neuropsychology, Phoenix, AZ.

Erickson, R.C., & Freeman, C. (1976). Using the MMPI 168 with medical inpatients. Journal of Clinical Psychology, 32, 283-291.

Eysenck, H.J., & Eysenck, S.B.G. (1963). Eysenck Personality Inventory. London: University of London Press.

Feibel, J.H., & Springer, C.J. (1982). Depression and failure to resume social activities after a stroke. Archives of Physical Medicine Rehabilitation, 63, 276-278.

Folstein, M.F., Maiberger, R., & McHugh, P.R. (1977). Mood disorder as a specific complication of stroke. Journal of Neurology, Neurosurgery and Psychiatry, 40, 1018-1020.

Fordyce, D.J., Roueche, J.R., & Prigatano, G.P. (1983). Enhanced emotional reactions in chronic head trauma patients. Journal of Neurology, Neurosurgery, and Psychiatry,46, 620-624.

Gainotti, G. (1972). Emotional behavior and hemispheric side of the lesion, Cortex, 8, 41-55.

Gasparrini, W.G., Satz, P., Heilman, K.M., & Coolidge, F.L. (1978). Hemispheric asymmetries of affective processing as determined by the Minnesota Multiphasic Personality Inventory. Journal of Neurology, Neurosurgery and Psychiatry, 41, 470-473.

Gass, C.S. (1991). MMPI-2 interpretation and closed head injury: A correction factor. Psychological Assessment: A Journal of Consulting and Clinical Psychology, 3(1), 27-31.

Gass, C.S., & Ansley, J. (1994). MMPI correlates of poststroke neurobehavioral deficits. Archives of Clinical Neuropsychology, 9(5), 461-469.

Gass, C.S. & Russell, E.W. (1986). Minnesota Multiphasic Personality Inventory correlates of lateralized cerebral lesions and aphasic deficits. Journal of Consulting and Clinical Psychology, 3, 359-363.

Gass, C.S., & Russell, E.W. (1991). MMPI profiles of closed head trauma patients: Impact of neurologic complaints. Journal of Clinical Psychology, 47(2), 253-260.

Getter, H., & Sundland, D.M. (1962). he Barron ego strength scale and psychotherapy outcome. Journal of Consulting Psychology, 26, 195.

Gilberstadt, H., & Duker, J. (1965). A Handbook for Clinical and Actuarial MMPI Interpretation. Philadelphia: Saunders.

Goldstein, K. (1948). Language and Language Disturbances. New York: Grune & Strutton.

Gough, H.G. (1948). A new dimension of Status: I. Development of a personality scale. American Sociological Review, 13, 401-409.

Graham, J.R. (1977). The MMPI: A Practical Guide (1st ed.). New York: Oxford University Press.

Graham, J.R. (1987). The MMPI: A Practical Guide (2nd ed.). New York: Oxford University Press.

Graham, J.R. (1990). MMPI-2: Assessing Personality and Psychopathology. New York: Oxford University Press.

Graham, J.R. (1991). Comments on Duckworth's review of the Minnesota Multiphasic Personality Inventory-2. Journal of Counseling and Development, 69, 570-571.

Graham, J.R., Timbrook, R.E., & Ben-Porath, Y.S. (1991). Code-type congruence between MMPI and MMPI-2: Separating fact from artifact. Journal of Personality Assessment, 57(2), 205-215.

Graham, J.R., Watts, D., & Timbrook, R.E. (1991). Detecting fake-good and fake-bad MMPI-2 profiles. Journal of personality assessment, 57(2), 264-277

Grant, I., & Alves, W. (1987). Psychiatric and psychosocial disturbances in head injury. In H.S. Levin, J. Grafman, & H.M. Eisenberg (Eds.), Neurobehavioral Recovery form Head Injury (pp. 215-231). New York: Oxford University Press.

Hathaway, S.R., & McKinley, J.C. (1940). A multiphasic personality schedule (Minnesota): I. Construction of the schedule. Journal of Psychology, 10, 249-254.

Herring, S., & Reitan, R.M. (1986). Sex similarities in verbal and performance IQ deficits following unilateral cerebral lesions. Journal of Consulting and Clinical Psychology, 54(4), 537-541.

Holland, T.R., Lowenfeld, J., & Wadsworth, H.M. (1975). MMPI indices in the discrimination of brain damaged and schizophrenic groups. Journal of Consulting and Clinical Psychology, 43, 426.

Hooke, J.F, & Marks, P.A. (1962). MMPI characteristics of pregnancy. Journal of Clinical Psychology, 18, 316-317.

Horn, L.J., & Garland, D.E. (1990). Medical and orthopedic complications associated with traumatic brain injury. In: M. Rosenthal, E.R. Griffith, M.R. Bond, & J.D. Miller (Eds.). Rehabilitation of the Adult and Child with Traumatic Brain Injury. (2nd ed.). (pp. 107-126). Philadelphia: Davis.

Hovey, H.B. (1964). Brain lesion and five MMPI items. Journal of Consulting Psychology, 28, 78-79.

Hovey, H.B. (1967). MMPI testing for multiple sclerosis. Psychological Reports, 21, 599-600.

Inglis, J., & Lawson, J.S. (1981). Sex differences in the effects of unilateral brain damage on intelligence. Science, 212, 693-695.

Jones, N.F., Kinsman, R.A., Schum, R., & Resnikoff, P. (1976). Personality profiles in asthma. Journal of Clinical Psychology, 32, 803-806.

Karlsen, B., & Gardner, E.F. (1986). Stanford Diagnostic Reading Test (3rd ed.). The Psychological Corporation: Harcourt Brace Jovanovich, INC.

Kaufman, A.S., McLean, J.E., & Reynolds, C.R. (1990). Empirical test of the Inglis and Lawson hypothesis about sex differences in WAIS and WAIS-R brain damage studies. Journal of Clinical and Experimental Neuropsychology, 12(2), 281-285.

Kay, D.W.K., Kerr, T.A., & Lassman, L.P. (1971). Brain trauma and the postconcussional syndrome. Lancet, ii, 1052-1055.

Keane, T.M., Malloy, P.F., & Fairbank, J.A. (1984). Empirical development of an MMPI subscale for the assessment of combat-related posttraumatic stress disorder. Journal of Consulting and Clinical Psychology, 52, 888-891.

Keller, L.S., & Butcher, J.N. (1991). Assessment of Chronic Pain Patients with the MMPI-2. Minneapolis: University of Minnesota Press.

Kendall, P.C., Edinger, J., & Eberly, C. (1978). Taylor's MMPI correction factor for spinal cord injury: Empirical endorsement. Journal of Consulting and Clinical Psychology, 46(2), 370-371.

Kleinke, C.L. (1994). MMPI scales as predictors of pain-coping strategies preferred by patients with chronic pain. Rehabilitation Psychology, 39(2), 123-128.

Kleinmuntz, B. (1960). An extension of the construct validity of the Ego Strength scale. Journal of Consulting Psychology, 24, 463-464.

Klove, H. & Doehring, D.G. (1962). MMPI in epileptic groups with differential etiology. Journal of Clinical Psychology, 24, 216-219.

Kolb, B., & Whishaw, I.Q. (1985). Fundamentals of Human Neuropsychology (2nd ed.). New York: W.H. Freeman and Company.

Lamb, D.G., Berry, D.T.R., Wetter, M.W., & Baer, R.A. (1994). Effects of two types of information on malingering of closed head injury on the MMPI-2: An analog investigation. Psychological Assessment, 6(1), 8-13.

Lansdell, H.C. (1970). Relation of extent of temporal removals to closure and visuomotor factors. Perceptual and Motor Skills, 31, 491-498.

Lansdell, H.C. (1971). A general intellectual factor affected by temporal lobe dysfunction. Journal of Clinical Psychology, 27, 182-184.

Lanyon, R.I. (1968). A Handbook of MMPI Group Profiles. Minneapolis: University of Minneapolis Press.

Leininger, B.E., Kreutzer, J.S., & Hill, M.R. (1991). Comparison of minor and severe head injury emotional sequelae using the MMPI. Brain Injury, 5, 199-205.

Levin, H.S. (1989). Neurobehavioral outcome of mild to moderate head injury. In J. Hoff, T. Anderson, & T. Cole (Eds.), Mild to Moderate Head Injury (pp. 153-155). Boston: Blackwell Scientific Publications.

Levin, H.S., Eisenberg, H.M., & Benton, A.L. (Eds.), (1989). Mild Head Injury. New York: Oxford University Press.

Levin, H.S., Gary, H.E., High, W.M., Mattis, S., Ruff, R.M., Eisenberg, H.M., Marshall, L.F., & Tabaddor, K. (1987). Minor head injury and the post concussional syndrome: Methodological issues in outcome studies. In H.S. Levin, J. Grafman, & H.M. Eisenberg (Eds.), Neurobehavioral Recovery form Head Injury (pp. 215-231). New York: Oxford University Press.

Levin, H.S., Grossman, R.G., Rose, J.E., & Teasdale, G. (1979). Long term neurpsychological outcome of closed head injury. Journal of Neirosurgery, 50, 412-422.

Levin, H.S., Mattis, S., Ruff, R.M., Eisenberg, H.M., Marshall, L.F., & Tabaddor, K. (1987). Neurobehavioral outcome of minor head injury: A three center study. Journal of Neurosurgery, 66, 234-243.

Levitt, E.E. (1990). A structural analysis of the impact of MMPI-2 on MMPI-1. Journal of Personality Assessment, 55(3&4), 562-577.

Levy, A. (1992). Compensation neurosis rides again. Brain Injury, 6, 341-410.

Lezak, M.D. (1983). Neuropsychological Assessment, (2nd ed.). New York: Oxford University Press.

Lishman, W.A. (1987). Organic Psychiatry, (2nd ed.). Oxford: Blackwell Scientific Publications.

Litz, B.T., Penk, W.E., Walsh, S., Hyer, L., Blake, D.D., Marx, B., Keane, T.M., & Bitman, D. (1991). Similarities and differences between MMPI and MMPI-2 applications to the assessment of posttraumatic stress disorder. Journal of Personality Assessment, 57(2), 238-253.

Louks, J., Calsyn, D., & Lindsay, F. (1976). Personality dysfunction and lateralized deficits in cerebral functions as measured by the MMPI and Reitan-Halstead battery. Perceptual and Motor Skills, 43, 655-659.

Lubin, B., Larsen, R.M., Matarazzo, J.M., & Seever, M. (1985). Psychological test usage patterns in five professional settings. American Psychologist, 40, 857-861.

Lyons, J.A., & Keane, T.M. (1992). Keane PTSD scale: MMPI and MMPI-2 update. Journal of Traumatic Stress, 5(1), 111-117.

Maccoby, E.E., & Jacklin, C.N. (1974). The Psychology of Sex Differences. Stanford, CA: Stanford University Press.

Mack, J.L. (1979). The MMPI and neurological dysfunction. In C.S. Newmark (Ed.), MMPI Clinical and Research Trends. (pp. 53-79), New York: Praeger.

Marsh, G.G. (1972). Parkinsonian patients' scores on Hovey's MMPI Scale for CNS disorder. Journal of Clinical Psychology, 28, 529-530.

McCreary, C. (1985). Empirically derived MMPI profile clusters and characteristics of low back pain patients. Journal of Consulting and Clinical Psychology, 53, 558-560.

McGill, J., Lawlis, G.F., Selby, D., Mooney, V., & McCoy, C. (1983). The relationship of Minnesota Multiphasic Personality Inventory (MMPI) profile clusters to pain behaviors. Journal of Behavioral Medicine, 6, 77-92.

McGlone, J. (1977). Sex differences in the cerebral organization of verbal function in patients with unilateral brain lesions. Brain, 100, 775-793.

McGlone, J. (1980). Sex differences in human brain asymmetry: A critical survey. Behavioral and Brain Sciences, 3, 215-263.

McGlone, J., & Kertesz, A. (1973). Sex differences in cerebral processing of visuospatial tasks. Cortex, 9(3), 313-320.

McKinley, W.W., Brooks, D.N., & Bond, M.R. (1983). Post-concussion symptoms, financial compensation and outcome of severe blunt head injury. Journal of Neurology, Neurosurgery and Psychiatry, 46, 1084-1097.

McKinley, W.W., & Kilfedder, C. (1992). Financial compensation and head injury. Brain Injury, 6(5), 387-389.

Meier, M.J., & French, L.A. (1965). Some personality correlates of unilateral and bilateral EEG abnormalities in psychomotor epileptics. Journal of Clinical Psychology, 31, 3-9.

Miller, H. (1961). Accident neurosis. British Medical Journal, 1, 919-925 and 992-998.

Norusis, M.J. (1985). SPSS-X Advanced Statistics Guide. New-York: McGraw-Hill

Novack, T.A., Daniel, M.S., & Long, C.J. (1984). Factors related to emotional adjustment following head injury. The International Journal of Clinical Neuropsychology, 6(2), 139-142.

Oddy, M. (1984). Head injury during childhood: The psychological implication. In N. Brooks (Ed.), Closed Head Injury: Psychological, Social, and Family Consequences (pp. 179-194). Oxford: Oxford University Press.

Paolo, A.M., Ryan, J.J., & Smith A.J. (1991). Reading difficulty of MMPI-2 subscales. Journal of Clinical Psychology, 47(4), 529-532.

Pantano, L.T. & Schwartz, M.L. (1978). Differentiation of neurologic and pseudo-neurologic patients with combined MMPI Mini-Mult and Pseudo-Neurologic Scale. Journal of Clinical Psychology, 34, 56-60.

Peck, E., Mitchell, S., Burke, E., Baber, C., & Schwartz, S. (1993). Normative data for 463 head injury patients for the MMPI, BDI and SCL90 tests across three time periods post injury. Poster presented at the Twenty-First Annual Meeting of INS. Galvaston, Texas.

Pincus, T., Callahan, L., Bradley, L., Vaughn, W., & Wolfe, F. (1986). Elevated MMPI scores for hypochondriasis, depression, and hysteria in patients with rheumatoid arthritis reflect disease rather than psychological status. Arthritis and Rheumatism, 57, 61-66.

Pope, K.S., Butcher, J.N., & Seelen, J. (1993). The MMPI, MMPI-2, and MMPI-A In Court. Washington, D.C.: American Psychological Association.

Prigatano, G.P. (1986). Personality and psychosocial consequences of brain injury. In G.P. Prigatano, D.J. Fordyce, H.K. Zeiner, J.R. Roueche, M. Pepping, & B.C. Wood (Eds.), Neuropsychological Rehabilitation after Brain Injury (pp.29-50). Baltimore: The Johns Hopkins University Press.

Prigatano, G.P. (1987). Psychiatric aspects of head injury: Problem areas and suggested guidelines for research. In H.S. Levin, J. Grafman, & H.M. Eisenberg (Eds.), Neurobehavioral Recovery form Head Injury (pp. 215-231). New York: Oxford University Press.

Prokop, C.K., Bradley, L.A., Margolis, R., & Gentry, W.K. (1980). Multivariate analysis of the MMPI profiles of patients with multiple pain complaints. Journal of Personality Assessment, 44, 246-252.

Repko, G.R., & Cooper, R. (1983). A study of the average workers' compensation case. Journal of Clinical Psychology, 39(2), 287-295.

Rimel, R.W., Giordani, B., Barth, J.T., Boll, T.J., & Jane, J.A. (1981). Disability caused by minor head injury. Neurosurgery, 9, 221-228.

Rosen, J.C., Grubman, J.A., Bevins, T., & Frymoyer, J.W. (1987). Musculoskeletal status and disability of MMPI profile subgroups among patients with low back pain. Health Psychology, 6, 581-598.

Ruff, R.M., Crouch, J.A., Troster, A.I., Marshall, L.F., Buchsbaum, M.S., Lottenberg, S., & Somers, L.M. (1994). Selected cased of poor outcome following a minor brain trauma: comparing neuropsychological and positron emission tomography assessment. Brain Injury, 8(4), 297-308.

Russell, E.W. (1977). MMPI profiles of brain damaged and schizophrenic subjects. Journal of Clinical Psychology, 33, 190-193.

Rutherford, W.H. (1989). Postconcussion symptoms: Relationship to acute neurological indices, individual differences, and circumstances of injury. In H.S. Levin, H.M. Eisenberg, & A.L. Benton (Eds.), Mild Head Injury. New York: Oxford University Press.

Schretlen, D.J. (1988). The use of psychological tests to identify malingered symptoms of mental disorder. Clinical Psychology Review, 8, 451-476.

Schwartz, M.L., & Cahill, R. (1970). Personality assessment in myasthenia gravis with the MMPI. Perceptual and Motor Skills, 31, 766.

Shaffer, J.W., Nussbaum, K., & Little, J.M. (1972). MMPI profiles of disability insurance claimants. American Journal of Psychiatry, 129(4), 63-67.

Shaw, D. (1966). Differential MMPI performance in pseudo-seizure, epileptic and pseudoneurologic groups. Journal of Clinical Psychology, 22, 271-275.

Shaw, D., & Matthews, C.G. (1965). Differential MMPI performance of brain damaged vs. pseudo-neurologic groups. Journal of Clinical Psychology, 21, 405-408.

Siegel, S. (1956). Nonparametric Statistics: For the Behavioral Sciences. (International student edition). Tokyo: McGraw-Hill Kogakusha.

Sinyor, D., Jacques, P., Kaloupek, D.G., Becker, R., Goldenberg, M., & Coopersmith, H. (1986). Poststroke depression and lesion location: An attempted replication. Brain, 109, 537-546.

Siskind, G. (1976). Hovey's 5-item MMPI scale and psychiatric patients. Journal of Clinical Psychology, 32, 50.

Skinner, H.A. (1979). A model of psychopathology based on the MMPI. In C.S. Newmark (Ed.), MMPI Clinical and Research Trends. (pp. 53-79), New York: Praeger.

Snow, W.G., & Sheese, S. (1985). Lateralized brain damage, intelligence, and memory: A failure to find sex differences. Journal of Consulting and Clinical Psychology, 53(6), 940-941.

Spreen, O., & Strauss, E. (1991). A Compendium of Neuropsychological Tests: Administration, norms, and commentary. New York: Oxford University Press.

Statistics Canada. (1989). Canadian Center for Health Information. Health Reports, 1(1).

Statistics Canada. (1992). Age, Sex and Marital Status. Ottawa: Supply and Services Canada. 1991 Census of Canada. Catalogue number 93-310.

Statistics Canada. (1994). Profile of urban and rural areas. Part B. Canada, provinces and territories. Ottawa: Industry, Science and Technology Canada. 1991 Census of Canada. Catalogue number 93-340.

Sternbach, R.A. (1974). Pain patients: Traits and treatments. New York: Academic Press.

Sternbach, R.A., Wolf, S.R., Murphy, R.W., & Akeson, W.H. (1973a). Aspects of chronic low back pain. Psychosomatics, 14, 52-56.

Sternbach, R.A., Wolf, S.R., Murphy, R.W., & Akeson, W.H. (1973b). Traits of pain patients: The low-back "loser". Psychosomatics, 14, 226-229.

Strassberg, D.S., Reimherr, F., Ward, M., Russell, S., & Cole, A. (1981). The MMPI and chronic pain. Journal of Consulting and Clinical Psychology, 49(2), 220-226.

Taylor, G.P. (1970). Moderator-variable effects on personality-test-item endorsement of physically disabled patients. Journal of Consulting and Clinical Psychology, 35, 183-188.

Tellegen, A., & Ben-Porath, Y.S. (1993). Code-type comparability of the MMPI and MMPI-2: Analysis of recent findings and criticisms. Journal of Personality Assessment, 61, 489-500.

Uomoto, J.M., & Esselman, P.C. (1993). Traumatic brain injury and chronic pain: Differential types and rates by head injury severity. Archives of Physical Medicine Rehabilitation, 74, 61-64.

Upper, D., & Seeman, W. (1968). Brain damage, schizophrenia, and five MMPI items. Journal of Clinical Psychology, 24, 444.

Vogel, W. (1962). Some effects of brain lesions on MMPI profiles. Journal of Consulting Psychology, 26, 412-415.

Watson, C.G. (1971).An MMPI scale to separate brain damaged from schizophrenic men. Journal of Consulting and Clinical Psychology, 36, 121-125.

Watson, C.G. (1973). A simple bivariate screening technique to separate NP hospital organics from other psychiatric groups. Journal of Clinical Psychology, 29, 448-450.

Watson, C.G., Davis, W.E., & Gasser, B. (1978). The separation of organics from depressives with ability- and personality-based tests. Journal of Clinical Psychology, 34, 393-397.

Watson, C.G., Plemel, D., & Jacobs, L. (1978). An MMPI sign to separate organic from functional psychiatric patients. Journal of Clinical Psychology, 34, 398-400.

Watson, C.G., & Thomas, R. (1968). MMPI profiles of brain damaged and schizophrenic patients. Perceptual and Motor Skills, 27, 567-573.

Wechsler, D. (1981). Wechsler Adult Intelligence Scale-Revised Manual. New York: The Psychological Corporation.

Whelan, T.B., & Walker, M.L. (1988). Effect of sex and lesion locus on measures of intelligence. Journal of Consulting and Clinical Psychology, 56(4), 633-635.

Wiggins, J.S. (1969). Content dimensions in the MMPI. In J.N. Butcher (Ed.), MMPI: Research Developments and Clinical Applications (pp. 127-180). New York: McGrow-Hill.

Wilson, H., Olson, W.H., Gascon, G.G., & Brumback, R.A. (1982). Personality characteristics and multiple sclerosis. Psychological Reports, 51, 791-806.

Woodward, J.A., Bisbee, C.T., & Bennett J.E. (1984). MMPI correlates of relatively localized brain damage. Journal of Clinical Psychology, 40, 961-969.

World Health Organization. (1987). Mental disorders: Glossary and guide to their classification in accordance with the 9th revision of the international classification of diseases. Geneva: World Health Organization.

Youngjohn, J.R., Burrows, L., & Erdal, K. (1993, October). Brain damage or compensation neurosis? The controversial post-concussion syndrome. Poster presented at the Annual Convention of the National Academy of Neuropsychology, Phoenix, AZ.

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.

4. K Scale. Subtle defensiveness, unwillingness to disclose personal information, positive self-image.

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 3. Hysteria (Hy). Use of repression and denial to manage conflict. Experience stress somatically. Suggestible, outgoing, manipulative, uninsightful.

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

Scale 5. Masculinity-Femininity (Mf). Sex role attitudes and behavior. Range of interests, degree of passivity.

Scale 6. Paranoia (Pa). Suspiciousness, guardedness, tendency to externalize blame, hostility, resentment.

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 9. Hypomania (Ma). Energy level, sociability, impulsiveness, optimism, impatience, grandiosity, irritability.

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.

F(b) 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.

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

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 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, quarrel some, 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:

Hy1- 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.

Sc6- 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 HI 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 NS)

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 Gass's (1991) correction factor.

* - Appears on both correction factors.

Appendix E

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

#	N1	F1	N2	F2	N3	F3	N4	F4	N5	F5	N6	F6
1	1456	10.0	234	17.5	100	53.0	1136	56.8	267	67.8	71	9.9
2	1461	95.9	233	82.0	100	85.0	1138	95.8	267	82.0	72	79.2
3	1461	65.6	234	13.7	100	25.0	1137	68.5	268	16.0	72	20.8
4	1461	38.5	233	19.3	100	12.0	1136	20.4	267	8.6	72	18.1
5	1462	54.0	234	73.1	100	59.0	1137	41.4	267	68.9	72	65.3
6	1457	89.8	233	89.7	100	92.0	1131	92.8	268	92.9	71	90.1
7	1459	41.0	233	29.2	100	53.0	1138	48.9	268	42.5	72	40.3
8	1460	64.4	233	36.9	100	75.0	1137	87.0	268	65.7	72	44.4
9	1462	82.2	234	44.0	100	56.0	1137	85.6	268	41.4	72	63.9
10	1462	86.5	233	2.6	100	18.0	1137	84.7	268	3.4	72	15.3
11	1461	5.3	234	20.1	99	14.1	1136	3.5	268	14.2	72	12.5
12	1453	74.1	231	52.4	100	52.0	1135	73.3	267	46.8	72	58.3
13	1455	34.5	233	25.3	98	37.8	1128	27.0	266	29.3	72	54.2
14	1458	68.7	233	59.2	100	60.0	1137	64.2	268	63.4	72	68.1
15	1460	36.4	231	48.5	99	37.4	1137	37.0	267	41.2	72	37.5
16	1460	40.1	234	31.6	100	38.0	1136	45.0	268	43.7	72	65.3
17	1461	6.0	233	15.5	97	18.6	1136	5.2	266	18.4	72	9.7
18	1461	3.8	234	15.4	100	13.0	1137	1.1	268	7.8	72	16.7
19	1439	28.9	234	13.7	98	29.6	1126	37.9	268	21.3	72	20.8
20	1460	77.1	234	63.7	100	87.0	1137	87.5	265	75.8	72	70.8
21	1457	41.2	234	47.4	100	38.0	1135	31.9	267	38.2	72	44.4
22	1460	8.8	233	19.3	100	25.0	1138	8.8	268	21.3	72	25.0
23	1461	18.2	234	27.4	100	16.0	1135	5.6	268	11.2	72	33.3
24	1460	2.0	232	2.2	100	3.0	1138	3.9	268	3.4	72	2.8
25	1461	44.4	234	38.9	100	40.0	1138	41.6	268	28.7	72	37.5
26	1461	39.7	233	38.6	100	46.0	1136	47.2	267	47.6	71	35.3
27	1461	13.6	234	7.3	98	29.6	1136	26.7	268	31.0	72	18.1
28	1460	9.1	234	37.2	100	22.0	1138	8.1	268	28.0	72	33.3
29	1460	81.9	234	77.4	100	80.0	1138	83.6	268	84.0	72	77.8
30	1461	6.0	233	18.0	100	27.0	1138	6.0	268	19.0	72	29.2
31	1461	12.5	233	40.8	100	63.0	1138	13.3	268	39.2	72	70.8
32	1459	18.2	232	17.7	99	39.4	1136	23.8	266	27.8	72	37.5
33	1460	64.0	231	28.1	100	29.0	1138	62.9	268	27.6	71	38.0
34	1459	80.7	232	83.6	100	88.0	1136	80.7	268	87.3	72	88.9
35	1462	36.9	233	34.3	100	56.0	1137	58.0	268	63.4	72	30.6
36	1462	6.3	232	10.3	100	15.0	1138	8.1	268	12.3	72	9.7
37	1462	37.8	233	50.6	100	50.0	1138	39.4	268	48.1	72	38.9
38	1461	27.5	233	59.2	100	57.0	1138	25.0	268	50.7	72	54.2
39	1461	13.8	231	67.5	100	49.0	1137	11.4	267	65.5	71	53.5

Note. # - Item number.
N1- Male Normative Sample size
F1- "True" endorsement frequency (EF) in N1
N2- Male chronic pain sample size
F2- "True" EF in N2
N3- Male head injury sample size
F3-"True" EF in N2
N4- Female Normative Sample size
F4- "True" EF in N4
N5- Female chronic pain sample size
F5- "True" EF in N5
N6- Female head injury sample size
F6-"True" EF in N6

40	1462	7.0	234	34.2	100	34.0	1138	3.3	268	26.1	72	37.5
41	1460	56.1	233	42.9	100	58.0	1138	63.0	268	46.6	72	36.1
42	1462	2.5	232	2.6	100	6.0	1135	4.1	268	6.0	72	2.8
43	1455	77.6	234	36.3	100	21.0	1135	79.0	268	39.9	72	23.6
44	1462	13.0	234	28.6	100	19.0	1137	2.4	268	19.0	72	31.9
45	1462	86.5	234	15.4	100	31.0	1138	86.9	268	14.6	72	27.8
46	1460	22.7	232	21.6	99	28.3	1137	18.8	267	19.5	72	40.3
47	1461	84.5	234	64.5	100	68.0	1137	81.5	268	66.4	72	69.0
48	1461	11.6	233	8.6	100	15.0	1137	11.7	268	11.6	72	15.3
49	1460	75.2	234	75.2	100	57.0	1138	66.8	268	61.9	72	68.1
50	1458	47.5	234	45.7	100	41.0	1135	55.9	268	66.0	72	38.9
51	1461	96.2	234	98.3	100	95.0	1138	93.6	267	94.0	72	94.4
52	1457	12.1	233	17.6	100	19.0	1134	17.2	268	31.7	71	15.5
53	1459	25.4	234	79.1	100	51.0	1138	18.8	268	83.6	72	59.7
54	1453	4.8	232	4.3	99	7.1	1133	6.5	267	9.4	72	8.3
55	1458	36.9	233	36.1	100	40.0	1137	43.6	268	39.6	72	44.4
56	1454	34.0	234	63.2	99	55.6	1131	31.5	267	61.8	72	47.2
57	1459	68.3	234	20.1	100	34.0	1137	73.4	267	23.6	72	19.4
58	1460	56.6	234	45.7	99	51.5	1138	60.9	268	54.5	71	39.4
59	1462	10.9	234	27.8	100	23.0	1138	6.7	268	22.4	72	27.8
60	1461	2.7	234	3.0	100	13.0	1138	2.5	268	4.9	72	8.3
61	1459	77.0	234	74.8	100	61.0	1135	70.0	266	72.9	72	70.8
62	1461	73.6	232	72.0	100	5.0	1135	4.7	267	3.4	72	70.8
63	1461	32.0	234	23.1	100	34.0	1137	54.2	268	50.4	72	15.3
64	1461	72.6	233	70.4	100	13.0	1136	21.5	268	20.5	71	59.2
65	1462	9.0	233	30.9	100	21.0	1138	5.9	268	31.3	72	19.4
66	1462	2.1	234	1.3	100	5.0	1135	4.6	268	6.0	72	1.4
67	1461	72.1	232	68.1	100	52.0	1135	51.3	267	39.0	72	70.8
68	1462	13.7	234	13.7	100	25.0	1138	27.8	268	34.7	72	12.5
69	1462	38.9	234	38.9	100	67.0	1137	62.0	268	71.6	72	37.5
70	1459	32.1	234	37.6	100	18.0	1134	18.7	268	18.7	72	33.3
71	1454	32.4	234	55.1	99	50.5	1130	30.7	268	57.5	71	39.4
72	1460	4.5	233	3.4	99	10.1	1136	4.3	267	4.1	71	4.2
73	1460	27.7	233	46.8	100	48.0	1138	17.1	268	41.4	72	52.8
74	1462	33.6	233	44.6	100	7.0	1138	11.9	268	13.1	72	22.2
75	1460	95.2	233	86.3	100	89.0	1138	94.8	268	90.3	71	93.0
76	1448	33.5	233	22.7	100	35.0	1133	40.7	267	38.2	71	23.9
77	1459	95.3	232	92.2	100	88.0	1138	93.4	268	87.7	72	94.4
78	1459	96.4	234	95.3	100	93.0	1137	95.0	268	92.5	71	95.8
79	1459	29.1	234	24.8	100	52.0	1134	41.9	268	35.8	72	37.5
80	1462	26.7	233	37.8	100	6.0	1138	7.2	268	8.6	72	29.2
81	1461	44.3	234	32.9	100	48.0	1133	51.5	267	49.1	72	37.5
82	1460	21.6	234	28.2	100	29.0	1138	18.5	267	27.7	72	27.8
83	1462	78.4	232	70.7	100	78.0	1136	78.8	268	70.9	72	65.3
84	1462	7.0	234	8.1	100	25.0	1138	17.3	268	34.3	72	9.7
85	1460	16.1	233	15.9	100	24.0	1138	18.5	268	20.9	71	14.1
86	1459	39.4	234	31.2	100	36.0	1135	45.2	268	28.4	72	33.3
87	1452	53.5	234	55.6	100	60.0	1134	49.7	268	55.6	71	50.7
88	1449	83.4	230	77.4	100	90.0	1133	89.7	268	88.8	72	88.9
89	1460	77.6	233	82.8	100	67.0	1136	68.8	268	67.2	72	72.2
90	1456	91.9	233	94.8	99	90.9	1133	91.8	268	93.3	69	92.8
91	1462	88.8	233	39.5	100	59.0	1138	89.2	267	30.3	72	58.3
92	1462	3.2	234	10.7	100	14.0	1137	5.5	267	12.4	72	11.1
93	1462	91.8	234	97.4	100	91.0	1138	86.5	268	92.2	72	95.8
94	1462	5.4	233	12.0	100	9.0	1138	4.8	268	13.1	72	12.5
95	1462	89.1	232	56.9	100	69.0	1136	89.4	268	59.7	71	71.8
96	1456	4.8	234	5.1	99	8.1	1137	9.1	268	10.8	72	8.3
97	1460	10.9	234	23.5	99	31.3	1135	11.0	267	21.7	72	22.2
98	1460	45.1	234	38.5	100	34.0	1137	36.9	268	32.8	72	37.5
99	1460	5.5	232	8.2	100	9.0	1136	5.0	268	9.0	72	5.6
100	1460	49.7	233	54.5	99	21.2	1137	27.6	268	25.0	72	59.7
101	1461	7.0	233	30.9	100	35.0	1138	3.4	268	23.1	72	33.3

102	1461	98.2	234	98.7	100	99.0	1138	96.4	268	97.8	72	98.6
103	1460	27.3	234	27.4	100	24.0	1133	33.4	268	42.2	72	27.8
104	1458	39.1	234	29.1	99	30.3	1135	41.0	267	40.8	72	33.3
105	1462	10.1	234	13.7	100	60.0	1136	30.9	268	51.9	72	15.3
106	1461	84.7	233	70.4	100	40.0	1136	81.9	268	78.4	72	43.1
107	1462	66.8	234	48.7	100	60.0	1138	66.6	268	57.8	72	56.9
108	1462	91.4	234	95.3	100	94.0	1138	90.6	268	96.6	72	100.0
109	1462	93.2	234	79.5	99	70.7	1138	94.3	268	79.9	72	69.4
110	1454	50.3	232	41.6	100	62.0	1136	57.7	267	59.2	72	48.6
111	1462	8.9	234	26.9	100	17.0	1137	6.1	267	18.7	72	25.0
112	1459	67.9	232	50.0	100	37.0	1137	57.7	265	37.0	72	27.8
113	1452	70.5	234	61.1	100	54.0	1132	62.1	267	59.2	72	61.1
114	1462	1.2	234	0.4	100	1.0	1138	2.5	268	2.6	72	2.8
115	1460	63.6	234	63.2	100	75.0	1138	72.6	268	74.6	72	61.1
116	1461	35.9	233	38.6	100	55.0	1136	29.6	268	44.8	72	65.3
117	1461	86.4	234	82.9	100	74.0	1138	82.9	268	73.5	72	84.7
118	1458	64.1	234	67.9	100	40.0	1138	63.4	268	46.3	72	51.4
119	1462	79.4	234	85.0	100	51.0	1138	43.4	268	41.8	72	72.2
120	1460	72.9	233	73.0	100	72.0	1138	71.8	268	73.9	72	65.3
121	1460	77.5	232	90.9	100	78.0	1134	63.1	267	73.8	72	94.4
122	1462	82.3	234	78.6	100	81.0	1135	80.7	268	71.3	72	77.8
123	1462	30.2	234	17.1	100	31.0	1138	41.4	267	31.3	72	27.8
124	1462	24.9	232	26.7	100	34.0	1138	29.2	268	34.7	72	31.9
125	1462	87.5	233	73.4	100	71.0	1138	89.2	268	78.4	72	84.7
126	1457	98.4	234	100.0	100	98.0	1134	96.6	267	98.9	72	98.6
127	1461	58.2	234	61.1	100	46.0	1136	36.2	266	39.5	72	68.1
128	1460	75.8	234	84.6	100	70.0	1138	65.7	268	73.1	72	65.3
129	1461	26.4	234	19.7	100	27.0	1137	30.4	268	22.8	72	26.4
130	1461	38.1	234	76.9	100	65.0	1138	34.3	268	72.4	72	68.1
131	1458	43.5	231	39.8	100	54.0	1134	46.6	268	48.9	72	55.6
132	1443	79.3	228	86.0	97	64.9	1123	69.6	265	78.9	72	66.7
133	1462	3.6	233	4.3	100	12.0	1136	16.6	268	20.9	72	4.2
134	1462	8.4	234	11.5	99	28.3	1137	16.0	268	23.1	72	23.6
135	1459	30.5	234	33.3	100	46.0	1138	31.5	268	41.8	72	45.8
136	1461	35.6	234	30.3	100	52.0	1136	38.8	268	36.6	72	34.7
137	1461	57.8	234	50.9	100	30.0	1137	20.8	268	6.7	72	47.2
138	1462	1.6	232	2.6	99	6.1	1138	2.4	268	7.1	71	8.5
139	1461	87.5	234	73.5	100	86.0	1135	93.4	268	85.4	72	75.0
140	1461	72.8	234	33.8	100	44.0	1138	77.4	268	36.9	72	43.1
141	1460	90.9	234	32.1	100	50.0	1138	94.3	268	43.3	71	45.1
142	1462	93.5	234	90.2	100	78.0	1138	92.8	267	85.5	72	86.1
143	1460	56.4	234	33.3	100	60.0	1138	73.4	267	46.4	72	41.7
144	1462	0.5	234	1.3	100	4.0	1138	1.3	268	5.6	72	5.6
145	1461	11.2	234	15.8	100	9.0	1136	9.1	268	19.8	72	18.1
146	1462	46.4	233	59.7	100	29.0	1138	12.9	268	20.5	72	58.3
147	1459	14.5	234	34.2	100	69.0	1137	15.4	268	29.5	72	73.6
148	1459	48.0	234	2.1	100	7.0	1138	44.8	268	1.5	72	6.9
149	1462	12.0	234	34.2	100	39.0	1138	8.1	268	22.8	72	44.4
150	1461	5.3	233	6.0	100	6.0	1136	6.1	268	7.1	72	8.3
151	1453	49.4	234	39.3	100	38.0	1137	46.2	268	38.4	72	47.2
152	1461	58.4	233	14.6	100	25.0	1136	70.6	268	25.7	72	11.1
153	1460	49.8	234	29.1	100	38.0	1135	49.8	268	32.1	72	37.5
154	1461	61.4	234	59.4	100	46.0	1137	42.3	268	47.0	72	66.7
155	1461	17.1	234	17.1	100	35.0	1138	30.4	268	27.6	71	28.2
156	1461	3.7	234	5.1	100	6.0	1138	6.5	268	13.4	71	7.0
157	1457	31.2	233	27.0	100	46.0	1138	40.8	268	42.5	72	27.8
158	1453	63.2	234	62.8	99	58.6	1130	52.0	268	52.2	72	73.6
159	1461	55.0	234	44.0	100	53.0	1137	73.0	268	67.9	71	36.6
160	1460	86.2	234	70.9	98	66.3	1138	78.5	267	54.7	72	65.3
161	1461	40.8	232	37.9	100	37.0	1138	31.8	268	37.3	72	33.3
162	1462	0.3	233	0.2	100	0.0	1138	0.8	268	0.7	72	0.0
163	1461	48.1	234	44.0	100	71.0	1137	70.8	268	64.6	72	54.2

164	1462	84.3	234	64.1	100	53.0	113.	90.8	268	70.1	72	43.1
165	1461	90.4	234	65.8	100	26.0	1136	90.3	268	75.7	72	15.3
166	1459	13.4	232	20.7	100	23.0	1136	15.1	267	30.7	72	18.1
167	1462	38.8	234	32.5	100	49.0	1135	39.4	266	44.4	72	31.9
168	1461	8.5	234	14.1	100	42.0	1136	9.2	268	14.6	72	40.3
169	1458	43.6	234	47.0	100	43.0	1136	43.4	268	52.2	71	38.0
170	1460	9.5	234	19.7	100	31.0	1138	7.1	268	16.0	72	20.8
171	1459	40.3	233	38.2	100	34.0	1135	42.3	268	48.1	72	40.3
172	1460	7.3	234	29.5	100	30.0	1138	9.2	268	29.5	72	31.9
173	1461	69.6	234	52.1	100	31.0	1138	62.6	267	40.1	72	31.9
174	1462	91.5	234	89.3	100	86.0	1138	89.5	268	85.8	72	70.8
175	1461	4.7	234	42.7	100	30.0	1137	4.2	267	41.6	72	30.6
176	1460	74.5	233	38.2	100	36.0	1137	85.4	267	50.6	72	19.4
177	1461	89.7	234	65.0	99	49.5	1138	91.0	267	73.4	72	54.2
178	1462	28.0	233	30.0	100	35.0	1136	24.3	268	32.5	72	36.1
179	1462	91.4	233	51.9	100	47.0	1136	92.9	268	49.6	72	51.4
180	1461	3.4	234	9.8	100	39.0	1138	4.6	268	7.8	72	36.1
181	1459	76.0	234	73.5	100	80.0	1136	76.8	268	81.7	72	75.0
182	1460	3.8	234	10.7	100	14.0	1136	3.2	268	11.2	72	20.8
183	1461	90.8	234	84.6	100	91.0	1137	87.9	268	85.8	72	93.1
184	1458	53.8	234	61.1	100	45.0	1137	50.2	268	63.8	72	52.8
185	1460	46.5	233	41.6	100	39.0	1137	43.0	268	42.2	72	40.3
186	1462	92.8	234	89.7	100	91.0	1138	94.1	268	94.0	72	91.7
187	1459	44.7	233	32.2	100	19.0	1137	25.9	268	14.9	72	30.6
188	1461	83.3	234	79.1	100	78.0	1137	84.5	268	78.0	71	71.8
189	1458	53.5	233	45.9	100	63.0	1137	60.4	267	56.2	72	41.7
190	1458	8.0	234	9.0	100	6.0	1135	4.1	268	6.0	72	15.3
191	1461	38.4	233	25.8	100	20.0	1138	35.3	268	18.3	72	31.9
192	1460	97.3	234	95.3	100	96.0	1137	97.6	268	95.9	72	95.8
193	1462	8.6	234	5.6	100	11.0	1138	7.2	268	9.0	72	5.6
194	1461	44.0	234	52.1	100	58.0	1138	50.2	268	51.1	72	37.5
195	1462	9.5	234	12.8	99	14.1	1137	8.5	267	12.4	72	9.7
196	1462	60.7	234	78.6	100	69.0	1136	48.3	268	66.4	72	73.6
197	1459	17.2	234	14.5	100	48.0	1137	51.2	268	58.2	72	13.9
198	1462	1.5	234	4.7	100	7.0	1138	1.7	268	3.7	72	4.2
199	1461	63.4	233	54.5	100	76.0	1134	86.7	268	70.9	72	55.6
200	1459	42.2	234	30.3	98	48.0	1136	45.0	268	36.2	72	44.4
201	1462	3.2	234	12.4	100	27.0	1137	23.7	268	61.2	72	4.2
202	1462	18.9	234	28.6	100	31.0	1136	19.1	268	31.3	72	33.3
203	1461	91.2	234	90.6	100	71.0	1138	80.2	268	79.1	72	84.7
204	1462	89.5	234	88.0	100	72.0	1137	81.4	268	74.3	72	80.6
205	1462	66.2	234	58.5	100	48.0	1137	48.5	268	45.1	72	58.3
206	1462	75.0	234	73.9	100	63.0	1137	78.0	268	80.2	72	59.7
207	1460	34.5	234	29.9	100	27.0	1137	31.9	268	35.1	72	23.6
208	1459	72.1	234	51.3	100	56.0	1135	70.0	267	52.1	72	63.9
209	1457	38.2	232	21.1	100	37.0	1135	56.9	267	50.6	72	18.1
210	1461	98.1	234	97.0	100	95.0	1137	97.8	268	95.5	72	93.1
211	1433	26.6	229	24.9	100	25.0	1126	28.0	262	35.5	71	21.1
212	1452	23.8	233	26.6	100	32.0	1131	31.0	267	24.7	71	26.8
213	1461	42.4	234	41.9	100	54.0	1138	40.5	268	47.0	72	51.4
214	1462	62.7	234	62.0	100	82.0	1136	73.2	267	77.2	72	68.1
215	1454	17.5	232	20.7	98	28.6	1134	14.6	265	24.9	72	26.4
216	1460	1.5	234	1.3	100	2.0	1137	2.6	268	1.5	72	2.8
217	1440	54.0	232	53.9	100	55.0	1123	56.2	268	46.3	70	54.3
218	1459	23.7	234	59.4	100	52.0	1132	30.1	268	72.4	71	46.5
219	1459	57.7	232	55.6	100	60.0	1134	51.3	268	49.3	72	55.6
220	1457	10.6	234	9.4	100	24.0	1135	25.0	268	24.3	72	11.1
221	1461	26.6	234	20.9	100	20.0	1138	28.0	268	29.5	72	27.8
222	1458	89.6	232	81.9	99	83.8	1133	89.2	267	71.2	72	88.9
223	1461	81.7	234	61.5	100	69.0	1138	84.4	268	68.3	72	75.0
224	1462	81.3	233	0.4	100	28.0	1137	81.8	267	3.4	72	23.6
225	1461	27.9	234	34.6	100	45.0	1137	33.7	268	41.0	71	33.8

226	1458	40.2	234	32.9	99	33.3	1138	37.0	268	31.7	72	40.3
227	1457	41.8	232	39.7	100	48.0	1134	39.9	268	57.8	72	48.6
228	1461	1.9	233	0.9	100	3.0	1135	3.8	268	3.4	72	2.8
229	1462	4.7	234	12.0	100	44.0	1138	7.5	268	15.3	72	37.5
230	1461	72.6	234	76.5	100	66.0	1137	73.5	268	66.4	72	65.3
231	1460	17.5	233	32.6	100	40.0	1137	30.8	268	34.0	72	16.7
232	1458	74.9	234	62.4	100	33.0	1137	70.3	268	51.5	72	38.0
233	1456	32.4	234	46.2	100	50.0	1135	35.2	268	40.3	71	45.1
234	1462	1.6	233	3.9	100	5.0	1137	2.9	267	11.2	71	7.0
235	1459	10.1	234	24.4	100	23.0	1135	17.7	268	41.4	72	19.4
236	1458	64.3	233	70.8	100	24.0	1136	30.8	268	31.3	72	58.3
237	1462	59.4	234	62.8	99	81.8	1136	77.6	268	75.0	72	63.9
238	1461	16.5	234	24.8	99	29.0	1137	25.9	267	35.2	72	25.0
239	1462	25.9	233	23.2	100	24.0	1136	42.0	268	41.8	72	15.3
240	1462	3.3	234	2.1	100	7.0	1138	6.6	268	4.1	72	5.6
241	1462	14.4	234	17.1	100	31.0	1135	19.7	267	26.2	72	30.6
242	1461	35.2	234	29.1	100	26.0	1137	34.7	268	36.9	72	27.8
243	1462	34.7	234	38.0	100	48.0	1137	32.4	268	41.4	72	40.3
244	1458	76.4	232	68.5	100	56.0	1135	67.0	267	57.3	72	68.1
245	1461	29.4	233	39.1	100	39.0	1135	31.6	268	36.9	72	41.7
246	1458	2.2	232	4.7	99	4.0	1135	3.3	267	4.5	72	6.9
247	1461	8.7	233	61.4	100	53.0	1136	9.5	267	64.8	72	37.5
248	1458	10.5	234	9.0	100	14.0	1137	14.2	268	16.8	72	9.7
249	1461	55.2	234	49.6	100	44.0	1137	58.6	268	54.9	72	43.1
250	1461	23.6	233	15.0	100	43.0	1136	42.2	268	37.3	72	12.5
251	1462	24.6	234	32.5	100	37.0	1136	23.8	268	33.6	72	30.6
252	1460	0.5	234	3.8	100	5.0	1138	1.4	268	1.9	72	8.3
253	1461	11.7	234	12.8	100	8.0	1136	12.5	268	11.9	72	15.3
254	1459	20.0	233	15.0	100	22.0	1134	23.8	268	31.3	72	20.8
255	1462	83.6	234	70.9	100	63.0	1138	78.3	268	60.4	72	54.2
256	1462	44.0	234	33.3	100	23.0	1138	31.8	267	29.2	72	43.1
257	1461	17.3	234	15.4	100	46.0	1137	52.2	268	60.8	72	19.4
258	1462	2.6	233	11.2	98	13.3	1138	2.4	268	14.2	72	11.3
259	1460	16.9	233	23.2	100	22.0	1136	18.4	268	32.1	72	18.1
260	1461	92.9	234	92.7	100	91.0	1138	95.8	268	95.9	72	83.3
261	1442	52.0	231	39.0	100	27.0	1122	56.4	268	41.8	72	31.9
262	1461	72.3	234	62.8	100	76.0	1138	78.3	268	73.5	72	56.9
263	1457	82.0	233	81.1	100	66.0	1136	72.5	267	73.4	71	83.1
264	1462	22.9	234	20.9	100	35.0	1138	44.5	268	43.7	72	23.6
265	1461	27.7	234	29.5	100	41.0	1138	33.9	268	35.4	72	34.7
266	1460	83.9	234	79.9	100	48.0	1137	59.1	268	40.3	72	87.5
267	1461	70.2	234	61.1	100	43.0	1138	63.9	268	55.6	72	59.7
268	1447	14.2	232	17.2	99	17.2	1131	21.0	267	18.7	72	13.9
269	1450	19.6	234	15.8	100	37.0	1132	27.6	268	23.9	71	15.5
270	1459	3.6	234	0.4	100	1.0	1137	6.3	267	9.4	72	2.8
271	1460	46.4	232	40.1	100	41.0	1135	39.4	265	41.9	72	59.7
272	1460	11.0	234	8.1	100	65.0	1135	63.2	268	64.9	72	11.1
273	1461	17.9	234	44.4	100	37.0	1137	16.0	267	36.7	72	30.6
274	1462	27.8	234	34.6	100	26.0	1138	21.3	268	25.7	72	36.1
275	1461	59.4	234	70.9	100	59.0	1138	53.2	268	70.5	72	72.2
276	1457	96.0	234	96.2	100	98.0	1135	96.3	267	96.6	72	98.6
277	1462	19.0	234	35.9	100	29.0	1137	17.5	268	23.1	72	27.8
278	1457	83.8	232	82.8	99	87.9	1138	87.3	265	86.0	72	80.6
279	1461	48.4	234	39.7	99	42.4	1136	48.3	268	43.3	72	51.4
280	1461	81.0	234	81.6	100	75.0	1137	79.8	268	81.3	72	80.6
281	1459	3.6	234	5.6	100	17.0	1138	5.4	267	9.4	72	12.5
282	1462	6.0	234	6.4	100	7.0	1136	4.8	268	7.5	72	8.3
283	1461	39.6	234	50.0	100	24.0	1136	37.9	266	49.2	72	33.3
284	1458	49.7	233	39.5	100	46.0	1137	53.8	268	48.9	72	38.9
285	1462	49.0	234	48.3	100	44.0	1135	40.7	268	40.7	72	51.4
286	1460	27.5	234	27.4	100	31.0	1133	32.8	268	45.9	72	29.2
287	1461	13.8	234	6.8	100	14.0	1136	34.0	267	18.4	72	2.8

288	1458	13.6	234	14.5	100	12.0	1136	10.6	268	13.1	72	25.0
289	1461	46.2	234	52.6	100	48.0	1137	28.9	268	41.0	72	43.1
290	1462	53.5	234	71.4	99	64.6	1136	55.4	267	70.8	72	58.3
291	1462	3.6	234	4.3	100	3.0	1137	3.6	267	3.7	72	6.9
292	1462	35.0	234	41.9	100	23.0	1138	25.9	268	27.6	72	31.9
293	1461	25.2	234	29.5	100	23.0	1138	26.3	268	30.6	72	16.7
294	1461	4.9	234	7.3	100	4.0	1135	2.1	267	4.1	72	8.3
295	1459	83.6	232	23.7	98	41.8	1133	85.5	267	26.6	72	36.1
296	1462	13.2	234	25.2	99	28.3	1138	11.2	268	20.9	72	62.5
297	1460	62.3	233	70.8	99	51.5	1134	57.0	268	66.0	72	62.5
298	1462	12.0	234	11.5	99	20.2	1136	12.7	268	19.8	72	29.2
299	1462	14.8	234	30.8	99	52.5	1138	14.9	268	28.7	72	52.8
300	1462	10.5	234	8.5	99	13.1	1137	7.1	268	8.6	72	20.8
301	1462	20.2	233	28.8	100	28.0	1138	14.8	266	24.1	72	36.1
302	1462	39.4	234	39.7	100	48.0	1137	40.0	268	46.6	72	55.6
303	1461	3.4	234	7.7	100	2.0	1138	1.6	267	4.9	72	6.9
304	1461	54.1	234	51.3	100	47.0	1137	48.3	268	58.2	72	50.0
305	1458	36.2	233	70.4	100	56.0	1138	29.3	268	70.1	72	65.3
306	1460	9.3	234	9.8	100	15.0	1138	13.0	268	12.3	72	13.9
307	1462	11.1	234	13.2	100	18.0	1137	8.9	268	7.8	72	29.2
308	1462	13.1	233	19.7	99	49.5	1137	17.1	268	22.4	71	45.1
309	1461	30.7	233	30.9	100	54.0	1137	28.5	268	36.9	71	62.0
310	1461	11.3	234	9.8	100	15.0	1138	9.4	268	11.2	72	15.3
311	1460	9.0	234	9.0	100	16.0	1138	8.3	268	11.9	72	23.6
312	1462	6.0	234	6.4	100	4.0	1137	4.2	267	6.7	72	5.6
313	1460	16.0	234	14.1	100	18.0	1136	19.5	268	16.4	72	9.7
314	1457	92.2	234	88.9	100	87.0	1138	88.4	268	82.8	72	90.3
315	1459	48.8	232	42.7	100	56.0	1138	48.2	268	50.4	71	62.0
316	1461	10.0	234	7.7	99	23.2	1137	14.9	268	15.3	72	19.4
317	1460	5.7	234	12.0	100	12.0	1138	5.5	268	15.3	72	22.2
318	1460	93.2	234	90.6	100	89.0	1138	94.6	268	92.5	72	80.6
319	1460	7.0	234	6.4	100	5.0	1138	3.8	268	4.5	72	12.5
320	1459	16.9	234	11.5	100	18.0	1138	13.9	268	14.6	72	18.1
321	1460	60.3	234	57.7	100	60.0	1138	72.4	268	66.0	72	55.6
322	1459	4.5	234	2.6	100	1.0	1138	2.8	268	2.2	72	4.2
323	1460	4.9	234	0.9	100	5.0	1137	4.8	268	4.5	72	6.9
324	1462	4.6	234	2.6	100	5.0	1137	7.7	267	9.0	72	4.2
325	1461	17.0	233	41.6	100	78.0	1138	18.9	268	38.4	72	83.3
326	1460	35.5	234	39.7	100	39.0	1137	26.4	268	31.7	72	47.2
327	1461	7.9	234	6.4	100	17.0	1138	9.5	268	14.2	72	13.9
328	1460	29.7	234	33.8	100	33.0	1138	23.4	268	32.1	72	34.7
329	1461	1.8	234	5.6	100	3.0	1138	1.6	268	3.0	72	5.6
330	1462	94.1	234	71.8	100	72.0	1136	91.2	266	69.9	72	62.5
331	1462	49.1	234	64.5	100	38.0	1137	30.7	268	41.0	72	61.1
332	1462	3.8	234	1.7	100	2.0	1138	4.7	268	5.2	72	0.0
333	1462	5.0	234	9.8	100	11.0	1138	6.2	268	14.6	72	5.6
334	1462	2.6	234	6.4	100	8.0	1138	2.5	268	17.5	72	2.8
335	1462	68.7	234	56.0	100	60.0	1137	70.4	267	59.9	72	68.1
336	1462	2.0	233	2.6	100	1.0	1136	1.6	268	2.2	72	0.0
337	1460	42.5	234	40.6	99	50.5	1138	42.1	268	36.6	72	52.8
338	1462	34.6	234	36.3	100	30.0	1136	33.6	268	37.3	72	38.9
339	1462	43.2	233	67.8	100	59.0	1137	37.3	268	57.5	72	70.8
340	1461	60.0	234	69.7	100	38.0	1138	38.2	268	45.6	72	61.1
341	1462	67.2	234	72.2	100	83.0	1138	64.8	268	66.4	72	84.7
342	1460	55.1	234	63.7	100	37.0	1136	51.7	268	65.3	72	40.3
343	1459	91.6	234	95.7	100	88.0	1134	89.5	268	93.3	72	83.3
344	1461	42.5	234	57.3	99	51.5	1138	56.6	268	62.3	71	32.4
345	1458	52.5	232	53.4	100	58.0	1131	61.9	268	64.2	71	76.1
346	1460	64.5	234	60.7	100	57.0	1138	68.5	268	75.0	72	45.8
347	1462	22.3	234	21.8	100	21.0	1137	21.0	268	25.0	72	23.6
348	1461	20.7	234	20.1	100	42.0	1137	23.4	268	26.9	72	26.4
349	1461	8.4	234	3.8	100	17.0	1138	8.0	268	7.1	72	9.7

350	1452	52.7	234	52.6	100	55.0	1137	68.9	268	67.2	72	51.4
351	1462	41.7	234	46.6	100	20.0	1137	14.6	268	11.9	72	43.1
352	1459	70.9	233	67.4	100	77.0	1136	72.5	268	73.5	72	70.8
353	1461	82.5	232	78.9	100	63.0	1136	72.6	268	66.0	71	69.0
354	1461	82.3	234	79.9	100	83.0	1138	81.6	268	80.6	72	84.7
355	1461	1.0	234	0.4	100	3.0	1138	1.2	268	1.9	72	1.4
356	1462	32.8	234	50.9	100	44.0	1137	36.5	268	56.3	70	38.6
357	1451	46.5	230	54.8	100	51.0	1136	49.1	265	59.6	72	51.4
358	1458	16.6	234	19.2	100	17.0	1138	20.4	268	28.7	72	11.1
359	1459	59.2	234	59.0	100	56.0	1137	60.2	268	58.6	72	45.8
360	1460	81.9	232	81.9	100	85.0	1137	85.5	268	83.6	72	75.0
361	1462	2.1	234	5.6	100	2.0	1138	4.3	268	6.7	72	2.8
362	1461	59.4	234	50.0	100	55.0	1137	59.2	268	54.1	72	55.6
363	1456	76.5	233	68.7	100	57.0	1134	71.7	268	68.3	72	63.9
364	1454	26.2	233	27.9	100	32.0	1137	13.9	268	18.7	72	38.9
365	1460	73.7	233	71.7	100	77.0	1138	76.0	268	81.7	72	75.0
366	1460	11.0	234	14.5	100	18.0	1137	15.3	268	20.5	72	2.8
367	1455	28.4	234	30.8	100	41.0	1136	29.7	267	40.4	72	40.3
368	1459	25.2	231	26.8	100	27.0	1137	18.5	267	19.9	72	23.6
369	1460	44.8	233	46.4	100	36.0	1134	33.5	267	31.8	72	43.1
370	1461	78.0	234	75.2	100	63.0	1137	70.9	268	63.8	72	62.5
371	1462	10.3	234	7.3	100	2.0	1138	4.2	268	2.6	72	11.1
372	1459	66.7	234	67.1	100	55.0	1137	68.9	267	59.6	72	50.0
373	1460	38.6	234	28.2	100	37.0	1133	51.8	268	38.8	72	22.2
374	1461	37.7	234	33.8	100	43.0	1138	42.9	268	47.4	72	36.1
375	1460	31.0	234	41.9	100	44.0	1136	30.8	266	48.9	72	44.4
376	1462	13.3	234	24.4	100	24.0	1138	8.7	268	29.9	72	22.2
377	1460	30.3	232	78.0	100	59.0	1137	25.1	262	72.6	72	58.3
378	1459	38.8	233	43.8	100	43.0	1134	32.9	268	44.0	72	41.7
379	1462	13.5	234	19.2	100	13.0	1136	14.3	268	19.8	72	12.5
380	1462	15.5	234	20.9	100	14.0	1137	15.7	268	17.2	72	12.5
381	1460	8.7	234	7.3	100	10.0	1136	8.9	268	13.8	72	9.7
382	1461	24.2	234	28.2	99	26.3	1137	22.7	268	33.2	72	25.0
383	1462	91.3	234	85.0	100	82.0	1137	89.8	268	86.6	72	88.9
384	1459	86.9	233	91.4	99	37.4	1128	42.9	267	27.3	72	79.2
385	1459	40.4	234	41.9	100	80.0	1136	69.0	268	61.9	72	45.8
386	1458	47.1	234	52.1	100	50.0	1138	39.0	268	54.9	72	47.2
387	1459	3.4	234	3.0	100	5.0	1137	4.7	268	4.5	72	5.6
388	1462	64.3	234	35.5	100	42.0	1136	75.0	267	49.4	71	39.4
389	1460	15.3	234	24.8	100	28.0	1138	16.9	268	38.1	71	18.3
390	1457	48.5	234	49.6	100	36.0	1133	36.4	268	44.0	72	37.5
391	1461	33.7	234	31.6	100	31.0	1137	35.2	268	39.2	72	26.4
392	1462	34.0	234	36.8	100	7.0	1138	17.0	268	23.5	72	20.8
393	1462	23.7	234	23.1	100	33.0	1136	29.4	268	27.2	72	22.2
394	1461	22.7	232	36.6	100	32.0	1138	18.9	268	45.9	72	36.1
395	1462	16.5	234	24.4	100	5.0	1138	6.0	268	4.9	72	23.6
396	1456	45.4	232	54.3	100	40.0	1136	39.5	267	50.2	72	43.1
397	1461	24.4	234	36.3	100	4.0	1137	10.0	268	15.7	72	9.7
398	1461	50.4	234	52.1	100	46.0	1136	50.3	268	54.5	72	47.2
399	1460	12.9	234	23.1	100	32.0	1138	11.5	268	25.7	72	34.7
400	1461	17.3	234	33.8	100	39.0	1137	16.4	268	26.1	71	31.0
401	1462	50.9	233	51.9	100	68.0	1138	67.3	268	68.3	72	69.4
402	1462	51.4	234	44.0	100	39.0	1138	40.2	268	36.9	72	48.6
403	1460	37.7	234	37.6	100	47.0	1135	39.8	268	50.7	72	34.7
404	1461	94.1	234	84.6	100	92.0	1136	95.2	268	91.0	72	87.5
405	1458	77.0	233	61.4	100	70.0	1137	86.8	268	70.1	72	48.6
406	1457	29.4	232	25.4	99	43.4	1132	45.9	268	47.0	72	25.0
407	1456	7.0	234	8.1	99	3.0	1134	10.7	268	15.7	72	2.8
408	1460	32.1	233	39.1	100	31.0	1134	26.9	266	38.0	72	37.5
409	1460	54.0	234	52.6	99	54.5	1137	38.9	268	54.1	72	55.6
410	1457	38.1	234	22.6	100	36.0	1136	39.7	268	38.1	72	36.1
411	1462	24.6	234	40.6	100	36.0	1138	19.5	268	34.0	72	37.5

412	1462	10.2	234	20.1	100	26.0	1137	15.8	268	36.6	72	20.8
413	1460	35.0	234	41.0	100	21.0	1138	29.5	268	35.8	72	25.0
414	1461	40.0	233	43.8	100	49.0	1138	51.2	268	60.1	72	27.8
415	1461	29.1	234	34.2	100	39.0	1136	27.4	267	41.6	72	40.3
416	1458	44.8	234	32.5	100	35.0	1133	60.3	268	42.2	72	25.0
417	1461	10.7	234	17.5	100	46.0	1137	32.5	268	44.8	72	15.3
418	1455	41.5	233	36.9	100	50.0	1134	45.1	268	53.7	71	39.4
419	1460	44.8	234	32.9	100	49.0	1137	52.6	268	47.0	71	50.7
420	1460	41.4	234	53.8	100	28.0	1138	46.1	268	56.7	72	31.9
421	1459	27.0	234	32.1	100	26.0	1137	20.1	268	25.0	72	30.6
422	1461	77.7	234	89.3	100	90.0	1137	84.2	266	91.0	72	84.7
423	1456	37.6	234	28.2	100	40.0	1135	45.6	268	38.4	72	27.8
424	1459	14.3	234	23.1	100	25.0	1135	10.3	267	13.5	72	23.6
425	1456	35.0	233	49.8	100	36.0	1136	36.3	267	46.4	72	38.9
426	1462	95.2	233	94.0	100	34.0	1136	44.0	268	38.1	72	94.4
427	1462	82.4	232	75.4	100	72.0	1137	83.0	268	82.8	71	73.2
428	1458	57.9	234	59.4	100	65.0	1136	56.8	268	65.7	72	50.0
429	1461	75.0	234	82.4	100	79.0	1136	70.2	267	79.0	72	75.0
430	1455	48.5	234	73.9	99	52.5	1136	37.6	268	70.5	72	65.3
431	1460	3.4	233	5.2	100	17.0	1137	8.5	268	23.9	72	9.7
432	1459	14.0	233	8.2	99	21.2	1138	20.7	268	11.6	72	5.6
433	1455	50.9	232	34.9	99	42.4	1134	55.1	266	39.5	71	46.5
434	1454	29.6	233	52.8	99	59.6	1126	36.8	268	50.7	72	44.4
435	1458	17.4	232	20.3	99	5.1	1135	7.0	268	6.3	72	22.2
436	1452	29.4	231	24.7	100	26.0	1131	36.5	268	31.3	72	26.4
437	1460	61.6	234	55.6	100	66.0	1136	63.1	267	67.0	72	59.7
438	1454	54.8	233	56.2	100	43.0	1137	31.2	268	42.9	72	62.5
439	1459	39.0	234	41.5	99	43.4	1136	42.6	266	41.7	72	43.1
440	1459	64.6	233	69.1	100	55.0	1135	74.4	268	72.4	72	68.1
441	1455	21.5	233	24.9	100	18.0	1137	10.9	268	13.1	72	18.1
442	1462	67.6	234	68.8	100	47.0	1136	60.7	268	59.7	72	63.9
443	1455	26.7	233	32.6	99	38.4	1129	32.2	265	41.1	71	23.9
444	1461	28.2	233	41.2	100	19.0	1135	21.9	268	42.2	71	29.6
445	1456	35.1	234	47.9	100	34.0	1133	38.7	268	57.5	72	34.7
446	1462	37.9	233	38.6	100	40.0	1138	33.7	267	25.8	72	37.5
447	1458	14.4	234	20.9	100	7.0	1138	10.7	268	13.1	72	12.5
448	1460	18.4	234	14.5	100	10.0	1136	18.4	268	11.9	72	13.9
449	1462	72.7	234	84.2	100	65.0	1138	62.4	268	71.6	72	59.7
450	1461	2.5	234	4.3	100	4.0	1136	2.1	268	4.5	72	12.5
451	1459	15.0	234	12.0	100	11.0	1133	12.1	267	15.0	72	15.3
452	1459	65.0	234	59.4	99	71.7	1137	68.6	268	77.6	72	65.3
453	1459	40.8	234	41.9	100	65.0	1137	65.0	268	69.8	72	36.1
454	1459	4.0	234	16.2	100	11.0	1136	4.8	268	16.8	72	8.3
455	1455	82.9	233	80.3	100	80.0	1134	83.3	268	83.2	72	81.9
456	1462	79.3	234	65.8	100	64.0	1137	57.6	268	55.2	72	70.8
457	1462	21.8	234	27.4	100	27.0	1137	14.6	268	13.8	72	33.3
458	1460	59.0	234	57.3	100	45.0	1138	45.4	268	49.6	72	38.9
459	1460	79.9	234	75.2	100	85.0	1134	83.2	267	76.4	72	79.2
460	1454	55.2	232	73.3	100	67.0	1133	63.9	268	73.5	72	59.7
461	1462	56.8	234	56.4	100	67.0	1136	57.6	268	60.8	72	48.6
462	1457	51.5	234	50.0	100	94.0	1138	86.5	268	88.1	72	68.1
463	1461	5.5	234	10.7	100	10.0	1138	4.4	268	10.4	72	18.1
464	1462	33.9	234	74.8	100	63.0	1138	24.5	268	63.1	72	76.4
465	1455	24.6	233	24.0	100	38.0	1138	58.4	268	57.5	72	18.1
466	1459	33.7	234	36.3	100	26.0	1137	31.9	268	39.6	72	30.6
467	1458	56.2	234	49.6	100	63.0	1137	80.5	268	61.9	71	38.0
468	1457	8.1	234	12.0	100	2.0	1137	2.8	268	3.4	72	12.5
469	1456	31.0	234	65.0	100	40.0	1136	14.8	268	44.0	72	56.9
470	1452	36.4	231	43.7	99	41.4	1129	32.2	266	47.4	71	42.3
471	1456	18.4	234	26.5	99	19.2	1136	7.3	268	9.0	72	31.9
472	1456	33.9	234	44.9	100	66.0	1135	32.1	268	42.9	72	77.8
473	1452	72.0	233	67.4	100	45.0	1127	50.6	265	52.8	72	65.3

474	1455	40.4	233	43.3	100	90.0	1135	89.6	268	91.4	72	54.2
475	1458	19.2	234	39.3	100	64.0	1135	15.4	268	28.7	72	76.4
476	1460	7.1	234	23.1	100	18.0	1136	3.8	267	11.2	72	31.9
477	1460	10.1	234	11.5	100	37.0	1136	42.9	267	40.8	72	16.7
478	1461	1.4	234	0.4	100	2.0	1138	0.7	268	0.7	72	1.4
479	1456	38.0	234	36.8	100	46.0	1136	43.4	267	40.8	72	40.3
480	1460	31.0	234	40.2	100	42.0	1138	27.7	268	37.7	72	45.8
481	1459	47.2	232	52.6	100	62.0	1137	52.9	268	60.1	72	62.5
482	1459	21.2	233	22.7	100	40.0	1138	15.0	267	21.0	72	45.8
483	1457	10.4	229	21.4	99	16.2	1134	11.2	267	20.2	71	8.5
484	1460	2.3	234	4.3	100	7.0	1138	3.8	268	4.5	71	4.2
485	1462	22.8	234	35.5	100	31.0	1137	17.2	267	29.2	72	30.6
486	1460	49.3	232	53.4	100	53.0	1137	46.1	268	57.8	71	62.0
487	1455	24.5	232	11.6	99	31.3	1136	34.2	267	20.2	72	13.9
488	1461	12.7	232	16.4	98	31.6	1135	15.7	264	22.7	72	16.7
489	1462	3.5	234	6.8	100	6.0	1137	6.7	267	15.0	72	1.4
490	1458	9.5	231	10.0	100	24.0	1134	12.3	268	16.0	72	11.1
491	1455	20.3	234	26.5	100	27.0	1130	10.6	267	18.7	72	43.1
492	1453	78.5	234	84.6	100	71.0	1132	78.6	266	77.4	72	83.3
493	1458	91.4	234	95.3	99	80.8	1136	85.3	267	84.6	72	90.3
494	1459	82.5	233	64.4	100	64.0	1135	82.1	267	62.9	72	73.6
495	1459	21.0	233	23.6	100	20.0	1136	23.3	266	24.8	72	20.8
496	1461	44.3	234	12.4	100	18.0	1136	49.0	268	16.4	72	16.7
497	1461	26.8	234	35.9	100	35.0	1135	21.4	268	39.9	72	29.2
498	1459	24.2	233	10.7	100	16.0	1135	13.1	267	7.1	72	13.9
499	1461	32.5	234	56.0	100	33.0	1138	32.7	268	50.0	72	48.6
500	1446	12.4	233	15.0	99	17.2	1126	8.2	268	15.3	71	22.5
501	1459	96.2	232	89.2	100	94.0	1137	92.3	267	87.6	72	95.8
502	1460	20.5	234	32.1	100	15.0	1138	27.8	268	31.0	72	12.5
503	1458	16.5	234	17.9	100	18.0	1136	13.1	268	11.6	72	20.8
504	1460	38.4	232	27.2	100	32.0	1135	38.0	268	30.2	72	27.8
505	1459	14.6	233	27.5	100	19.0	1134	10.7	267	26.6	72	18.1
506	1462	3.8	231	13.0	100	14.0	1136	4.2	268	19.4	72	9.7
507	1461	26.0	234	29.9	100	43.0	1138	30.8	268	38.8	72	31.9
508	1461	23.4	234	23.9	100	16.0	1138	20.7	268	17.2	72	18.1
509	1462	42.5	234	44.4	100	40.0	1137	25.0	268	34.7	72	62.5
510	1462	21.1	234	20.1	100	40.0	1138	33.5	268	34.3	72	22.2
511	1460	9.1	234	3.0	100	14.0	1138	19.6	267	7.5	72	6.9
512	1462	23.5	234	33.8	100	33.0	1138	14.8	267	29.2	72	34.7
513	1461	22.7	232	38.8	100	45.0	1138	17.3	267	35.6	72	45.8
514	1458	74.1	234	79.5	100	63.0	1136	69.4	267	76.0	72	63.9
515	1451	11.0	234	9.8	100	15.0	1134	10.8	268	10.1	72	16.7
516	1461	3.2	233	12.0	100	8.0	1137	3.3	268	10.8	72	9.7
517	1459	2.3	232	11.6	98	20.4	1136	3.7	268	11.2	72	18.1
518	1459	20.9	233	36.5	100	33.0	1137	27.3	267	46.8	72	27.8
519	1459	35.7	233	54.5	100	29.0	1134	25.7	268	32.1	72	33.3
520	1461	1.9	231	10.8	100	7.0	1138	1.8	267	10.1	72	5.6
521	1461	62.2	234	51.7	99	53.5	1138	72.6	268	68.7	72	51.4
522	1459	49.1	232	48.3	100	42.0	1133	49.8	267	42.7	71	50.7
523	1459	46.9	234	50.9	100	60.0	1137	63.8	267	64.0	72	61.1
524	1461	4.5	231	7.4	100	2.0	1135	1.5	268	6.7	72	2.8
525	1458	12.7	234	28.2	100	27.0	1137	6.8	268	20.9	71	26.8
526	1460	3.7	234	26.5	100	13.0	1138	4.9	268	23.1	72	18.1
527	1460	7.9	234	3.4	100	10.0	1137	14.2	268	7.1	72	1.4
528	1453	6.3	233	17.2	100	24.0	1132	7.2	268	22.0	72	20.8
529	1460	24.8	234	32.5	100	28.0	1137	19.0	268	30.2	72	34.7
530	1460	1.1	234	0.9	100	1.0	1138	0.5	268	2.2	72	1.4
531	1449	13.4	233	21.0	99	14.1	1132	17.0	268	22.8	71	8.5
532	1462	68.2	234	79.1	100	37.0	1134	28.9	266	41.7	72	70.8
533	1460	40.0	234	51.7	100	75.0	1136	36.9	268	49.3	72	79.2
534	1457	62.7	234	46.6	100	52.0	1137	64.4	268	54.5	72	52.8
535	1456	60.9	232	58.2	100	41.0	1138	55.4	268	54.5	72	62.5

536	1462	25.2	234	41.0	100	40.0	1136	9.4	268	20.1	72	54.2
537	1461	23.8	233	36.1	100	48.0	1137	39.1	268	60.4	72	26.4
538	1449	40.0	233	29.6	100	33.0	1125	38.6	267	39.3	72	36.1
539	1459	7.0	233	21.5	100	20.0	1138	5.6	268	25.4	72	23.6
540	1460	3.5	232	4.3	100	13.0	1137	7.5	268	15.3	72	2.8
541	1462	77.8	232	69.8	99	55.6	1138	72.2	268	54.1	72	68.1
542	1462	56.2	234	66.7	100	44.0	1138	43.3	268	57.5	72	50.0
543	1458	21.1	234	23.5	100	13.0	1138	16.5	268	16.8	72	13.9
544	1454	2.2	231	3.0	99	6.1	1128	4.9	268	93.3	71	1.4
545	1460	44.0	234	40.6	99	36.4	1138	36.5	268	31.3	71	42.3
546	1457	14.3	233	14.2	100	15.0	1137	12.5	268	14.9	72	15.3
547	1461	68.7	234	68.4	100	56.0	1137	69.9	268	63.8	72	61.1
548	1451	7.4	232	5.6	100	22.0	1129	18.2	267	29.6	72	8.3
549	1462	10.9	234	35.0	100	26.0	1137	13.4	268	38.1	72	19.4
550	1461	16.4	234	20.9	97	35.1	1137	27.0	268	32.5	72	25.0
551	1461	17.4	234	23.5	100	22.0	1137	12.6	268	19.4	72	16.7
552	1456	72.2	234	67.5	100	61.0	1134	57.3	268	58.6	72	70.8
553	1459	14.8	234	17.9	100	12.0	1137	17.5	268	17.2	71	9.9
554	1461	14.2	232	31.9	100	27.0	1137	8.6	268	23.1	72	25.0
555	1461	3.7	234	4.7	100	0.0	1138	2.4	268	1.5	72	8.3
556	1461	36.8	234	58.1	100	49.0	1136	31.9	267	50.9	71	46.5
557	1458	36.8	234	51.7	99	44.4	1129	53.5	268	65.7	72	34.7
558	1461	14.9	234	26.9	99	25.3	1138	14.3	268	24.3	72	29.2
559	1444	10.9	228	25.0	98	16.3	1130	15.4	266	34.6	70	14.3
560	1446	38.9	231	33.3	100	29.0	1137	41.0	268	26.5	70	37.1
561	1460	86.0	234	34.6	99	59.6	1135	92.4	267	54.7	72	45.8
562	1461	36.5	234	46.6	100	32.0	1137	27.5	268	33.5	72	48.6
563	1455	19.5	233	18.0	100	24.0	1129	19.2	265	20.0	72	18.1
564	1458	72.2	232	58.2	100	62.0	1136	80.5	268	67.9	72	50.0
565	1458	10.8	234	32.9	100	70.0	1137	11.1	268	33.2	72	70.8
566	1453	27.9	231	45.0	98	39.8	1132	31.4	267	40.1	72	34.7
567	1451	31.5	234	23.9	99	25.3	1130	7.6	267	20.2	71	22.5

Appendix F

Comparison of item lists from Gass (1991) Alfano et al. (1993) and the current study.

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

Item #	Item	Alfano	Gass	current
13.(106)	My speech is the same as always (not faster or slower, no slurring or hoarseness).	X	X	X
14.(119)	I like collecting flowers or growing house plants.			X
15.(137)	I used to keep a diary.			X
16.(146)	I cry easily.	X		X
17.(147)	I cannot understand what I read as well as I used to.	X	X	X
18.(149)	The top of my head some-times feels tender.	X	X	
19.(159)	I have never had a fainting spell.	X		
20.(164)	I seldom or never have dizzy spells.	X		
21.(165)	My memory seems to be alright.		X	
22.(168)	I have had periods in which I carried on activities without knowing later what I had been doing.	X		X
23.(170)	I am afraid of losing my mind.		X	
24.(172)	I frequently notice that my hand shakes when I try to do something.		X	
25.(175)	I feel weak all over much of the time.		X	
26.(176)	I have very few headaches.	X		
27.(177)	My hands have not become clumsy or awkward.	X		
28.(179)	I have had no difficulty in walking or keeping my balance.	X	X	
29.(180)	There is something wrong with my mind.	X	X	X
30.(229)	I have had blank spells in which my activities were		X	X

interrupted and I did not know what was going on around me.

Item #	Item	Alfano	Gass	current
31.(241)	It is safer to trust nobody.		X	
32.(247)	I have numbness in one or more regions of my skin.	X	X	
33.(266)	I have never been in trouble with the law.			X
34.(295)	I have never been paralyzed or had any unusual weakness of any of my muscles.	X	X	
35.(299)	I cannot keep my mind on one thing.	X		X
36.(307)	I feel anxiety about something or someone almost all of the time.		X	
37.(308)	I forget right away what people say to me.			X
38.(309)	I usually have to stop and think before I act even in small matters.			X
39.(325)	I have more trouble concentrating than others seem to have.	X	X	X
40.(472)	I have had periods in which I carried on activities without knowing later what I had been doing.	X		

CURRICULUM VITAE

Galia Artzy

October 1994

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:

1987-present	Ph.D. (in progress), University of Victoria, B.C.
1983-1987	M.A., psychology, The Hebrew University, Jerusalem.
1980-1983	B.A., psychology, The Hebrew University, Jerusalem.

PROFESSIONAL AFFILIATIONS:

American Psychological Association (APA)
International Neuropsychological Society (INS)

CLINICAL EXPERIENCE:

FELLOWSHIP

1991-1992	Neurobehavior and Alzheimer's Disease Center, Beth Israel Medical Center, New-York.

INTERNSHIP

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.

PRACTICA

1992-present	F. Spellacy & Associates Ltd., 1005 Balmoral Rd., Victoria B.C.
1987-1988	Gorge Road Rehabilitation Hospital Victoria, B.C.
1984-1985	Department Of Psychiatry, Shaare Zedek Medical Center, Jerusalem.

ACADEMIC EXPERIENCE:

1991-1992	Instructor of neuropsychology, and neuropsychological assessment. Supervisor of clinical psychology interns and externs, Beth Israel Medical Center, New-York.
1986-1987	Instructor of neuropsychology, and supervisor of first year M.A. neuropsychology students, Shaare Zedek Medical Center, Jerusalem. Teaching Assistant, Hebrew University, Jerusalem.
1985-1986	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.
1984-1985	Teaching Assistant, Hebrew University Jerusalem.
1983-1984	Head of Research Team, directed by Dr. M. Rosenthal, Department of Education, Hebrew University, Jerusalem.
1982-1983	Head of Research Team, directed by Prof. Z.C. Greenbaum, Department of Psychology, Hebrew University, Jerusalem.
1981-1982	Research Assistant, with Prof. Z.C. Greenbaum, Department of Psychology, Hebrew University, Jerusalem.

HONORS AND AWARDS

1989-1990	University Fellowship, University of Victoria, B.C.
1988-1989	University Fellowship, University of Victoria, B.C.
1987-1988	University Fellowship, University of Victoria, B.C.
1986-1987	Intern Fellowship, Hebrew University, Jerusalem.
1985-1986	Intern Fellowship, Hebrew University, Jerusalem.
1984-1985	Dean's List, Hebrew University, Jerusalem

PARTIAL COPYRIGHT LICENSE

I hereby grant the right to lend my thesis (or dissertation) to users of the University of Victoria Library, and to make single copies only for such users or in response to a request from the Library of any other university, or similar institution, on its behalf or for one of its users. I further agree that permission for extensible copying of this thesis for scholarly purposes may be granted by me or a member of the University designated by me. It is understood that copying or publication of this theses for financial gain shall not be allowed without my written permission

Title of Thesis:

Author:_____
(signature)

Ms Galia Artzy
(name)

December 20, 1994
(date)