MANUAL FOR

THE MAYO-PORTLAND ADAPTABILITY INVENTORY (MPAI-4)

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OVERVIEW

The Mayo-Portland Adaptability Inventory (MPAI) was primarily designed:

- to assist in the clinical evaluation of people during the postacute (posthospital) period following acquired brain injury (ABI), and
- to assist in the evaluation of rehabilitation programs designed to serve these people.

Evaluation and rating of each of the areas designated by MPAI-4 items assures that the most frequent sequelae of ABI are considered for rehabilitation planning or other clinical interventions. MPAI-4 items represent the range of physical, cognitive, emotional, behavioral, and social problems that people may encounter after ABI. MPAI-4 items also provide an assessment of major obstacles to community integration which may result directly from ABI as well as features of the social and physical environment. Periodic re-evaluation with MPAI-4 during postacute rehabilitation or other intervention provides documentation of progress and of the efficacy and appropriateness of the intervention. Currently the MPAI is employed by a number of provider groups to evaluate the efficacy of the range of postacute rehabilitation interventions through pre- and post-intervention assessments of those served. Providers using the MPAI represent the full range of postacute services from community-based services through traditional outpatient rehabilitation and day programs to residential services.

Now in its fourth revision, the MPAI-4 and its three subscales (Ability Index, Adjustment Index, Participation Index) offer measures with highly developed and well documented psychometric properties. These measures may be effectively employed in **research applications** as well as in clinical settings. The psychometric properties of the inventory are reviewed in detail in following sections. The brief 8-item Participation Index may serve as a particularly useful measure of the final common aim—societal participation—of rehabilitation or other intervention efforts. The psychometric qualities of other measures used for assessment of people during the postacute period following ABI have been criticized by several sources in the professional literature.[1-3]

Throughout its development, the MPAI has been designed for possible completion by professional staff, people with ABI and their significant others (SO). Recent research (reviewed subsequently) establishes the reliability of completion by these various rater groups and also documents characteristic biases of each. The MPAI-4 offers the possibility for combining results of the inventory completed by two or three rater groups to provide a potentially more reliable and representative assessment.

MPAI-4 Items and Subscales

The underlying subscale structure of the MPAI was explored extensively in analyses of data from previous versions of the MPAI. These analyses led to the identification of three domains or subscales. Items were identified that correspond to rational grouping for three categories: **Ability** (i.e., sensory, motor, and cognitive abilities); **Adjustment** (i.e., mood, interpersonal interactions); and **Participation** (e.g., social contacts, initiation, money management). Items by subscale or *Index* are listed in Table 1. Three items (Initiation, Social contact, Leisure/recreational activities) contribute to both the Adjustment Index and the Participation Index). The MPAI-4 provides the rehabilitation professional or other clinician

with a brief and reliable means of assessing functioning in each of these three major domains to help target areas for intervention and assess progress.

Table 1: MPAI-4 Items by subscales

Ability Index	Adjustment Index	Participation Index
Mobility	Anxiety	Initiation
Use of Hands	Depression	Social contact
Vision	Irritability, anger, aggression	Leisure/recreational activities
Audition	Pain and headache	Self-care
Motor Speech	Fatigue	Residence
Communication	Sensitivity to mild symptoms	Transportation
Attention/Concentration	Inappropriate social interaction	Work/school
Memory	Impaired self-awareness	Money management
Fund of Information	Family/significant relationships	
Novel problem-solving	Initiation	
Visuospatial Abilities	Social contact	
Dizziness	Leisure/recreational activities	

TEST MATERIALS AND USE

Test Materials

The MPAI-4 consists of this manual and the MPAI-4 form. The manual contains information on the development of the MPAI, detailed instructions for rating and scoring the items, interpretative guidelines, normative data, and information on the reliability and validity of the measure. The MPAI-4 form consists of four pages that contain brief instructions for completing the ratings for each item, the 29 items comprising the MPAI-4, 6 additional items (items 30-35) for recording additional preinjury and postinjury information about the person being evaluated, and the scoring area. A French language version of the MPAI form has been developed by Dr. Pierre North and colleagues in Strasbourg, France. All materials for the MPAI-4, including the French language version, are available for download on the web site (www.tbims.org/combi/mpai) for the Center for Outcome Measurement in Brain Injury (COMBI) sponsored by the National Institute of Disability and Rehabilitation Research (NIDRR) through its TBI Model System Program.

User Qualifications

The MPAI-4 may be completed by people with ABI, their SO, medical or rehabilitation professionals, and other designated observers who know the individual well. People with very severe cognitive impairment should not complete the MPAI. Professional staff should review the rating guidelines provided in this manual prior to making ratings. People with ABI or their SO should have a professional who is experienced with the MPAI-4 review the rating guidelines with them prior to making ratings and be available to them to answer any questions that may arise during their completion of the inventory.

Currently we recommend that people with ABI and SO complete the same version of the MPAI as staff. In clinical practice, comparisons among independent ratings by staff, people with ABI, and SO can offer information about the varying perspectives of each of these rater groups. Examination and discussion of these varying perspectives are often critical for effective rehabilitation planning.

Scoring and interpretation of the MPAI-4 require professional training and experience. A person with advanced training in psychometrics, as well as tests and measurements will ideally be available to a clinical team that uses the MPAI-4 for clinical evaluations and should be involved when the MPAI-4 is used for program evaluation or research. Interpretation of the MPAI-4 by professionals in the clinical setting requires specific experience with the instrument and with ABI in addition to basic knowledge of tests and measurements.

ADMINISTRATION AND SCORING

Completing the MPAI-4

A separate form for the MPAI-4 should be used by staff, people with ABI, and their SO if the inventory is to be completed by multiple raters. Staff may complete the inventory by consensus using one form. Consensus evaluation by staff results in the most reliable and accurate assessment. If a single staff person completes the MPAI-4, it is recommended that other staff be consulted who have evaluated or treated the person with ABI. To complete the MPAI-4, begin by placing the name of the person with ABI at the top of the first page. A space for a "clinic number" or other number that links the person to other information specific to the facility is also provided. Date the inventory and circle (or write in) who is completing the inventory. Then rate each item. Brief descriptions to assist in making these individual item ratings are provided on the MPAI-4 form.

Guidelines for Rating Individual Items

The first 29 items of the MPAI-4 indicate current status or "outcome" after ABI. Rasch analyses have revealed that a single dimension represented by these 29 items possesses substantial internal consistency. Additional analyses have indicated that this primary dimension includes three regions that more specifically represent Ability, Activity, and Social Participation. Items contributing to each of these regions are identified in the three subscale Indices.

The MPAI-4 is designed primarily to represent the sequelae of ABI. **Nonetheless, the first 29 items of the MPAI-4 should reflect the current status of the person being rated whether or not conditions other than brain injury are contributing to restrictions in Ability, Activity, or Participation.** This is because it is often very difficult, if not impossible, to determine what factors (i.e., brain injury, other factors) are contributing to current status. If other preexisting or coexisting conditions are present that are contributing to restrictions rated in the first 29 items of the MPAI-4, these will be identified in items 30-35 of the inventory.

Professional staff using the MPAI-4 should be familiar with the rating recommendations described in this manual. Persons with ABI and their SO who rate themselves or those close to them on the MPAI-4 cannot be expected to study the manual. When such individuals are making ratings on the MPAI-4, they should have access to a staff person familiar with rating recommendations in this manual who can respond to their questions and advise them if they are unsure about how to respond to specific items.

Guidelines for and examples of rating each of the items of the MPAI-4 follow.

1. Mobility: Problems walking or moving about including balance problems. This item deals with difficulties moving oneself from place to place, either by walking without assistance, with assistance, or moving about with assistive devices including a wheelchair. Balance problems are included in this category if they interfere with mobility.

0 No problems in moving about; independent mobility without assistance or assistive devices.

1 Problems in mobility are apparent on examination but do not interfere with any normal activities of daily living including climbing stairs or moving at a rapid rate when required. These activities may be accomplished with the help of an assistive device. For example, people who use a cane or a brace to ambulate may score at a level 1 if they are able to accomplish all normal activities required for mobility including climbing a flight of stairs and moving at an increased rate, for instance, to avoid unexpected traffic. People scoring at this level may also show mild gait disturbances on clinical examination, provided that these do not interfere with the kinds of activities mentioned above.

2 Gait disturbance or other mobility impairment interferes some but not the majority of the time (less than 25%). Examples of this level of problem would be people using wheelchairs who are able to accomplish all normal activities of daily living independently with the exception of climbing stairs, or ambulatory people who cannot always move rapidly when required or are limited in a few other specific aspects of mobility like having difficulty in rough terrain. If such problems occur rarely (i.e., < 5% of the time), the person would be rated at level 1.

3 Mobility impairment interferes much of the time (25% to 50%), restricts many activities, and precludes a few. Examples of this level of problem would be people using wheelchairs who must avoid a substantial number of activities because of difficulties in independently working the wheelchair, or those who require assistance with the wheelchair much of the time but are able to move short distances on their own. This level of problem would also include people who are able to ambulate within a confined area without assistance but are restricted in many other activities that require ambulation including moving substantial distances independently.

4 Assistance is required in moving from place to place most or all of the time. Examples would be people who are able to ambulate only very short distances independently, are confined to bed, or require assistance more than 75 percent of the time in moving about in a wheelchair.

2. Use of Hands: Impaired strength or coordination in one or both hands.

0 Normal strength and coordination both on clinical examination as well as in activities of daily living with both hands.

1 Problems with dexterity or speed in one or both hands are apparent on clinical examination. However, these problems do not interfere substantially with activities of daily living. It is possible, although unlikely, that some people at this level lack complete or substantial use of one hand provided that their adaptation requires no external assistance

2 Impairment interferes some but not the majority of the time. Examples would be people who require assistance in a few activities, such as, cutting up their food, or who are unable to participate in a few activities because of upper extremity impairment like playing a game of catch.

3 Impairment interferes much of the time. Typically, at this level, people need substantial assistance with many aspects of instrumental activities of daily living. Examples would be a people who are able to dress themselves independently, or almost independently, but need assistance with most other activities which require finer motor dexterity, such as writing, set up for meals, or opening doors.

4 Assistance is required in all or almost all activities of daily living because of upper extremity impairment. Typically people at this level are unable to dress without assistance. Many activities that require the use of hands such as, writing or using utensils for eating, cannot be accomplished or are accomplished with extreme difficulty.

3. Vision: Problems seeing; double vision; visual field deficits; other eye, brain, or nerve injuries that interfere with seeing. Visual disturbances which are due to perceptual disorders rather than impairment of the primary visual system should be rated under item 11 (visuospatial abilities). For example, visual neglect should be rated under item 11, if there is no field cut or peripheral visual disturbance.

0 Normal near and close vision with the use of corrective lenses, providing that the corrective lenses were not made necessary by the injury.

1 Normal activities of daily living are accomplished despite mild visual disturbance. Examples would be people with very mild or intermittent double or blurry vision. Other examples include those with loss of vision in one eye who, with compensation techniques, continue to perform all daily activities including driving.

2 Visual disturbance interferes some but not the majority of the time in specific activities. Examples of this mild level of impairment are people whose only restriction is being unable to drive because of visual problems, or who are unable to participate in some sports or leisure activities because of visual disturbance.

3 Assistance is required in many activities of daily living. For example, people who have difficulty reading and require information to be read to them, or have difficulty recognizing faces because of visual problems, or cannot participate in many sports or leisure activities because of visual problems.

4 Visual impairment interferes with all or almost all activities. Typically at this level, people are legally blind and need assistance in most activities that require seeing including reading and recognition of faces. Those who have become adept at compensating for blindness may be rated at a lower level (1,2,3) depending on the degree to which blindness interferes with everyday activities.

4. Audition: Problems hearing, ringing in the ears that interferes with hearing or other activities.

0 The person has a normal audiological examination or clinical tests of hearing and demonstrates no impairments in daily living because of hearing.

1 Hearing impairment is apparent on examination but does not interfere with daily life. Examples are people who function normally with the help of a hearing aid, or who have mild tinnitus at a level that does not interfere with daily life.

2 Hearing problems interfere only some and not the majority of the time. Examples of this level of impairment are people who require occasional repetition in communication because of impaired hearing, or who avoid a few activities or situations because of hearing problems.

3 Hearing problems interfere much of the time. An example of this level is the person who participates in interpersonal communication only with great difficulty because of hearing problems and may require frequent repetition in everyday communication.

4 Hearing loss interferes in all or almost all activities. At this level people are typically legally deaf and require the use of a sign language interpreter or writing for interpersonal communication. Legally deaf people who have become adept at using compensation techniques for deafness may be rated at a lower level (1,2,3) depending on the degree to which deafness interferes with everyday activities.

5. Dizziness: Feeling unsteady, lightheaded, or dizzy. If dizziness is associated with balance problems that interfere with mobility, also rate balance problems as a disturbance of mobility at the appropriate level under Item 1.

0 No symptoms or complaints.

1 Mild symptoms which do not interfere with everyday activities or are effectively eliminated with medication.

2 Dizziness interferes with some but not the majority of activities and precludes some vocational activities such as working at heights.

3 Dizziness interferes with many activities, precludes more than very part-time community-based employment, and raises significant safety concerns, particularly in activities such as driving.

4 Dizziness is almost totally disabling and interferes or precludes most activities throughout the day. In extreme cases, movement from a supine position without symptoms of dizziness is not possible.

6. Motor speech: Abnormal clearness (articulation, phonation), or rate of speech; dysarthria and apraxia of speech. Aphasia and impairments in the pragmatics of communication should be rated under item #6.

0 Normal communication with no evidence of speech impairment on clinical examination

1 Impairment is apparent on clinical examination but rarely interferes in daily life. For example, people who experience very intermittent stuttering or slurring of words at a level that does not interfere substantially in most interpersonal communication situations. Another example would be someone who communicates at a normal rate with the use of a vocalizer.

2 Motor speech impairment interferes in some but not the majority of communication situations. For instance, stuttering or slurring of speech requires the other person in the communication to ask for repetition more than occasionally but not more than about 25% of the time.

3 Speech impairment results in frequent requests for repetition from the listener or use of alternative devices, such as, writing or a communication board much of the time for effective communication. Conceivably at this level, people may be completely mute but are able to carry on communication with the use of a word board or electronic communication system. A mute person who is very adept at the use of such an alternative device for communication may qualify for rating at level 2 but will almost never qualify for level 1 because the use of such devices significantly slows interpersonal communication.

4 Muteness or severe dysarthria. At this level, people are not adept at the use of an alternative device to the degree that interpersonal communication is laborious and ineffective more than 75 percent of the time.

7A. Verbal Communication: Problems expressing thoughts through language or understanding such expressions from others.

0 Normal verbal communication skills, that is, speaking, writing, listening.

1 Mild impairments in language (i.e., word finding or naming problems) that do not interfere significantly with conversational and functional communication.

2 Mild deficits in the use of language interfere with functional communication some but not the majority of the time. Examples are people who are aphasic on formal evaluation but whose communication is functional for conversational purposes; aphasia is apparent only when communication becomes more complex, or people whose language impairment is confined to writing or naming.

3 Mild to moderate aphasia interferes much of the time with interpersonal communication. People at this level of impairment usually are not able to engage effectively in conversational interchange without significant help from other people involved in the communication.

4 Moderate to severe aphasia interferes with all or almost all interpersonal communications. People at this level of impairment are usually able to communicate only about very basic needs and not able to engage effectively in conversational interchange even with support.

7B. Nonverbal Communication: Problems expressing thoughts through gestures, facial expression, or other non-language behaviors or understanding such expressions from others; deficits in the pragmatics of communication (e.g., tangentiality or other organization of language and non-language communications, turn-taking in conversation, hyper- or hypo-verbosity or other lack of modulation in verbal or nonverbal expressions, poor listening without receptive aphasia, for instance, due to distractibility or impulsivity.

0 Normal nonverbal and pragmatic communication skills.

1 Mild impairments usually in language (i.e., word finding or naming problems) that do not interfere significantly with conversational and functional communication, for instance, absence or reduced facial expressiveness.

2 Mild deficits in nonverbal communication or pragmatics interfere with functional communication some but not the majority of the time. Examples include limited gesturing, distractibility, mild tangentiality, and verbosity which do not create barriers in most communication situations but are noticeable in more demanding communication situations.

3 Deficits in nonverbal or pragmatic communication much of the time with interpersonal communication. People at this level of impairment usually are not able to engage effectively in conversational interchange without significant help from other people involved in the communication.

4 Very severe pragmatic communication impairment interferes with all or almost all interpersonal communications. At this level, pragmatic communication skills are so impaired or so frequently inappropriate that almost continuous support from others is required in any communication beyond a very brief and simple exchanges.

8. Attention/Concentration: Problems ignoring distractions; difficulty shifting attention from one thing to another; difficulty sustaining attention. If memory lapses are reported that are due primarily to attentional deficits, code the appropriate level of attentional impairment and code Item 8 (Memory) as "1." Without neuropsychometric testing, it is difficult to distinguish between memory lapses that are due to attention as opposed to a primary memory disorder. One sign that attention is the primary problem is when the person describes most memory problems as being unable to retrieve specific information at specific times but appears to be able to remember the information at others times. For example, forgetting a person's name but remembering it later with no additional help, or forgetting an appointment but then remembering it later.

0 Normal attention and concentration in functional settings and on neuropsychometric testing (when available)

1 Variable attention and distractibility are apparent on neuropsychometric testing, apparent in clinical evaluations and interviews, or is a complaint but does not interfere more than minimally (<5% of the time) with everyday activities including communication. In some cases, the lack of interference with everyday activities may be due to the implementation of compensation techniques, external supports, or reduced environmental demands, or attention is *within normal limits* with medication.

2 Variable attention and distractibly interfere with activities some but not the majority of the time. At this level, interference is usually apparent only in highly demanding attentional situations such as communication in group settings or activities that require a high degree of sustained attention. At this level, attention problems result in some restriction of activities, particularly educational and vocational activities or driving. However, with reduction in environmental demands for attention, such problems are more of an annoyance and do not pose serious problems.

3 Attentional impairment interferes in most settings. Recommendations for environmental modifications, compensation, or medication to improve function are appropriately considered. At this level of impairment, people are usually not able to maintain community-based employment. Attentional impairment is severe enough to create critical or dangerous situations and may preclude some activities such as driving or operating power equipment that require sustained attention for safety.

4 Attentional impairment interferes with virtually all activities. People at this level appear distractible most of the time and require frequent redirection or focusing in conversational interactions and most activities. People at this level cannot drive safely, operate power equipment, and usually require at least partial supervision in most activities.

9. Memory: Problems learning and recalling new information

0 Normal learning and delayed recall demonstrated in functional settings and on neuropsychometric testing (when available)

1 Mild memory impairment is apparent on formal assessment such as neuropsychometric testing but does not interfere with everyday functioning more than very occasionally. Alternatively at this level, people complain of memory lapses—which may be attributable to other factors, such as, concentration, emotional issues—even though no impairment of memory is apparent on formal assessment. In some cases, the lack of interference with everyday activities may be due to the implementation of compensation techniques, external supports, or reduced environmental demands. People demonstrate more moderate memory impairment on formal testing but have become proficient enough at using compensation techniques (such as, memory notebook) that memory impairment interferes only minimally with everyday activities.

2 Memory impairment interferes some but not the majority of the time in activities either with or without compensation. Memory lapses should be due to forgetting not just unreliable concentration. In other words, new information is truly lost to recall with the passage of time and not just because of trouble retrieving information due to variable concentration or other factors. Memory problems at this level result in some restriction of activities, particularly vocational or educational activities. However, with reduction in environmental demands for attention, such problems are more of an annoyance and do not pose serious problems.

3 Memory impairment (forgetting) interferes with most activities. Unless memory problems are very severe, usually people at this level are not reliably compensating for memory problems. Recommendations for developing memory compensation methods are appropriately considered. At this level, memory problems severely limit vocational options and typically preclude community-based employment. Memory problems can create critical or dangerous situations for the individual such as forgetting to take medications or leaving the stove on and some supervision may be required.

4 Learning and retention of new information are very limited and this severe memory impairment interferes with virtually all activities. For many people at this level of impairment, self-directed compensation techniques are not possible because of memory impairment and environmental cuing and other environmental supports will be required to increase functional abilities.

10. Fund of information: Problems remembering information learned in school or on the job; difficulty remembering information about self and family from years ago.

0 Normal retrieval of remotely acquired information. If neuropsychometric testing is available, scores on tests of fund of information or vocabulary knowledge are in the average range or above (i.e., 25th percentile or higher). Autobiographical recall is intact.

1 A few but significant deficits in knowledge of common cultural information. Few, if any, deficits in retrieving significant personal history. Psychometric estimates of "fund of information" are in the low average range (i.e., 10th to 25th percentile).

2 Infrequent but noticeable deficiencies in fund of information, knowledge of cultural standards, or personal past history. Psychometric estimates of "fund of information" are between the 5th and 10th percentile.

3 Relatively frequent deficiencies in cultural knowledge or retrieval of personal history are apparent. Psychometric estimates of "fund of information" are between the 1st and 5th percentile.

4 Marked deficiencies in knowledge and ability to describe personal history. Psychometric estimates of "fund of information" are below the 1st percentile.

11. Novel problem-solving: Problems generating solutions or picking the best solution to new problems. Novel problem-solving in this context refers primarily to conceptual problems rather than interpersonal problems. Impairment in conceptual problem-solving and reasoning may interfere with solving interpersonal or other life problems. However, emotional issues may also interfere with problem-solving in relationships and real life situations. For instance, people with unimpaired or even superior reasoning ability may exercise poor judgment because they are angry at someone or about something. To the extent possible, this item rates only the thinking and conceptual reasoning part of problem-solving. Emotional and behavioral factors should be rated under appropriate subsequent items. Also included in this category is the ability to conceptually organize information and activities, to plan, and to develop and maintain a systematic personal schedule.

0 Normal problem-solving and abstract reasoning in functional and everyday activities and on neuropsychometric testing (when available).

1 Mild impairment of reasoning or problem-solving may be apparent on formal testing or other assessment situations but does not appear to interfere in everyday life. In some cases, the lack of interference with everyday activities may be due to the implementation of compensation techniques, external supports, or reduced environmental demands.

2 Impairment in problem-solving and abstract reasoning interferes with some but not the majority of activities of everyday life. People at this level need infrequent help from others in addressing problems, for instance, making significant changes in financial affairs or future plans. Impairment in this area may also limit vocational options. However, impairment in problem-solving and reasoning rarely, if ever, result in serious problems or safety concerns.

3 Impairment in problem-solving and reasoning interferes with many activities and may result intermittently in serious problems or safety concerns. Impairment significantly limits vocational options and may preclude community-based employment in all but very routine jobs. Impairment recommends regular supervision or consultation from others in addressing significant life changes or financial decisions.

4 Impairment interferes in almost all everyday activities that require development of a new perspective or a new plan to address a life problem. At this level, people have or should have formal supervision in the conduct of financial affairs, and usually require some degree of supervision in independent living because of impaired judgment and reasoning.

12. Visuospatial abilities: Problems drawing, assembling things, being visually aware of both the left and right sides. Visual neglect should be rated under this item. Primary impairment in the visual system (e.g., hemianopsia) should be rated under Item 3 (Vision).

0 Normal visuospatial abilities in functional and everyday activities and on neuropsychometric testing if available.

1 Mild problems in visuospatial abilities or mild neglect are apparent on formal assessment. However, people at this level are able to compensate for these mild deficits to the degree that impairment does not interfere with everyday activities or present a safety risk.

2 Impairment in visuospatial abilities or visual neglect interferes with some but not the majority of everyday activities and may limit vocational and other activities. Even at this mild level of impairment, driving or operating power equipment may not be recommended because of safety concerns. However, other than such activities that require a high degree of visual attention or visuomotor abilities for safety, serious problems or safety concerns because of visuospatial impairment rarely occur.

3 Impairment in visuospatial abilities or neglect interfere with many activities and severely limit vocational options without compensatory or environmental accommodations. Impairment is associated with significant safety concerns even in routine everyday activities. That is, the person is at significant risk for getting lost, negotiating stairways, missing important information on one side of visual space. Impairment at this level precludes driving or other activities (such as, operating power equipment) that require intact visual attention and visuomotor abilities for safety.

4 Impairment in visuospatial abilities or neglect interferes with most activities of every day life. Significant environmental accommodations and/or supervision for safety are usually required.

13. Anxiety: Tense, nervous, fearful, phobic, symptoms of posttraumatic stress disorder such as nightmares, flashbacks of stressful events.

0 No complaints or evidence of abnormal tension or anxiety

1 Infrequent or mild symptoms of tension or anxiety but these do not interfere with activities and usually do not require further evaluation or treatment. Symptoms do not create significant disruption in interpersonal or other activities and may appear appropriate reactions to significant life stress. Individuals who are currently involved in effective treatment (such as, pharmacologic or psychotherapeutic) would also be rated at this level.

2 Mild anxiety that interferes with some but not the majority of activities. At this level, people usually appropriately receive a psychiatric diagnosis, such as, Adjustment Disorder with Anxiety, PTSD, Anxiety Disorder NOS, or a specific phobia. At this level, anxiety most often only interferes with social or interpersonal activities.

3 Anxiety is sufficiently severe to interfere with many activities including vocational activities. As for level 2, these people usually appropriately receive a psychiatric diagnosis.

4 Anxiety is disabling. Examples at this severe level would be people who are unable to work because of anxiety or unable to leave the house because of severe agoraphobia.

14. Depression: Sad, blue, hopeless, poor appetite, poor sleep, worry, self-criticism.

0 Normal mood and variation in mood

1 Infrequent or mild symptoms of depression that do not interfere with activities and usually do not require further evaluation or treatment. Symptoms do not create a significant disruption in interpersonal or other activities and may appear appropriate reactions to significant life stress. People who are currently involved in effective treatment for depression (such as, pharmacologic or psychotherapeutic) would also be rated at this level.

2 Mild depression that interferes with some but not the majority of activities. At this level, individuals usually appropriately receive a psychiatric diagnosis, such as, Adjustment Disorder with Depressed Mood, Major Depression, or Mood Disturbance due to Brain Injury. At this level, depression may be most apparent in reduced social or interpersonal activities.

3 Depression is sufficiently severe to interfere with many activities including vocational activities. As for level 2, people at this level usually appropriately receive a psychiatric diagnosis.

4 Depression is disabling and people at this level may require hospitalization. Examples at this severe level would be people who are unable to work or almost completely socially isolated because of depression, or those who are actively suicidal.

15. Irritability, anger, aggression: Verbal or physical expressions of anger.

0 Normal control of aggressive impulses.

1 Intermittent displays of anger or aggression, usually at the level of "irritability." These do not create a significant disruption in interpersonal or other activities and may appear appropriate reactions to significant life stresses and frustrations.

2 Mild loss of control of aggressive impulses is reported or observed. Such behaviors create a disruption in interpersonal activities but usually do not interfere significantly with or jeopardize vocational activities. Lack of control of aggression usually presents itself in social or family situations at this level. A psychiatric diagnosis, such as, Adjustment Disorder with Disturbance of Conduct or Personality Change due to Brain Injury can usually be appropriately applied, although at this level, the disorder may also be secondary to a primary depressive disorder or to marital or family discord.

3 Lack of control of aggressive impulses interferes frequently in social activities and, for those who are employed, will typically create problems at work. At this level, aggression is usually displayed during the clinical evaluation as well. Psychiatric diagnosis is appropriate.

4 Severe lack of control of aggressive impulses may present a significant threat to others, at least intermittently; people at this level may require hospitalization, residential treatment, or extensive supervision.

16. Pain and headache: Pain complaints and behaviors. If pain originates from multiple body areas, for example, head and back, rate overall impact.

0 No significant pain reported.

1 Pain is present but does not interfere or interferes only minimally with activities and is not associated with significant pain complaints or behaviors. For instance, people who report when asked that their headaches have increased since the injury but who do not spontaneously complain of pain or engage in behaviors that draw attention to their discomfort.

2 Pain complaints and behaviors occur at a frequency that interferes with a some but not the majority of activities. At this level, pain may be associated with specific types of activities or situations, for instance, high stimulation environments, physically demanding activities, or sudden intense stimulation (noise, bright lights) which are avoided.

3 Pain complaints and behaviors interfere much of the time and can interrupt any activity to the point that people with this level of pain must withdraw from the activity. Pain at this level is a significant obstacle to community-based employment.

4 Pain complaints and behaviors are totally or almost totally disabling. People at this level spend significant amounts of time on bed rest or in isolation because of pain. They typically cannot work because of pain.

17. Fatigue: Feeling tired, low in energy; fatigability, that is, feeling low in mental or physical energy after a relatively low level of mental or physical activity. Fatigue may be a symptom of depression and should not be rated here unless it appears to be a problem that exists independent of depression.

0 No significant fatigue reported or observed.

1 Fatigue is present but does not interfere or interferes only minimally with activities. For instance, people at this level may indicate that they tire out more easily but compensate for fatigue by pacing their activities with more frequent rest breaks or through other methods. As a result of their adaptation, fatigues does not present a significant obstacle to their overall level of activity.

2 Fatigue interferes with some but not the majority of activities. At this level, fatigue may only be a problem only during more demanding physical and mental activities.

3 Fatigue interferes much of the time and can interrupt any activity that requires more than a small amount of physical or mental exertion. Fatigue at this level is a significant obstacle to working full-time in community-based employment.

4 Fatigue is totally or almost totally disabling. People at this level are usually inactive during most of the day because of fatigue.

18. Sensitivity to mild symptoms: Focusing on posttraumatic cognitive, physical or emotional problems. Rate only how distress or concern about other symptoms affects current functioning over and above the effects of the symptoms themselves. In some cases, concern about posttraumatic and postconcussive symptoms can become a problem in and of itself. This item represents such disturbances that may range from mild anxiety about the symptoms to extreme worry and obsession. At more severe levels, focusing on symptoms interferes with participation in rehabilitation, psychological, or other recommended treatments. Some people become so focused on proving that they have a neurologic condition that they are unable to effectively engage in treatment or other activities that may help them to re-engage in life and feel better. In some cases, denial or minimization of psychological or interpersonal problems also have a negative impact on adjustment as well as participation in and benefit from treatment.

0 Emotional reactions and concerns about symptoms are appropriate.

1 Distress about, focusing on symptoms, or denial of psychological issues is mildly excessive but does not interfere with activities or participation in treatment. At this level, concern about symptoms does not interfere with engagement in rehabilitation, psychological, or other treatments.

2 Distress about, focusing on symptoms, or denial of psychological issues interferes with some but not the majority of activities as well as with recommended rehabilitation and other treatments. At this level, people can usually be engaged in rehabilitation and other treatments directed at improving adjustment but concern about symptoms interferes with participation.

3 Distress about, focusing on symptoms, or denial of psychological issues interferes with many activities and presents a clear obstacle to rehabilitation and psychological or other treatment. People at this level usually feel that rehabilitation and other interventions that increase adjustment to the problem fail to recognize the critical nature of the problem.

4 Distress about, focusing on symptoms, or denial of psychological issues creates a disability in and of itself. At this level, people usually reject rehabilitation, psychological, or other interventions aimed at increasing adjustment and engage in no activities that may reasonably be expected to improve their situation. They may “doctor shop” to secure incontrovertible proof of a neurologic disorder or a cure.

19. Inappropriate social interaction: Acting childish, silly, rude; behavior is not consistently fitting to the time and place. This item represents a variety of disinhibited behaviors which most people find inappropriate to the social situation. Inappropriate lack of response should not be rated here but should be rated under Item 22 (Initiation).

0 Normal behavior in social situations.

1 Infrequent or very mildly disinhibited or socially inappropriate behavior in social situations. At this level, inappropriate behavior is apparent at a greater frequency than for most people but is not so unusual that it seriously jeopardizes interpersonal relationships, work, or consistently disrupts social encounters.

2 Disinhibited or socially inappropriate behavior is apparent in some but not the majority of social situations. At this level, inappropriate responses usually occur in informal social settings and less so at work or in other structured social environments. Inappropriate behavior may occasionally create problems at work but does not occur so frequently that employment is seriously jeopardized.

3 Disinhibited or socially inappropriate behavior occurs in many social encounters in both informal and more structured social settings including at work. It is a serious obstacle to employment and may preclude community-based employment.

4 Disinhibited behavior is apparent almost continuously. People at this level may require supervision or placement in a supervised setting because of their behavior. Disinhibition at this level would clearly preclude community-based employment.

20. Impaired self-awareness: Lack of recognition of personal limitations and disabilities and how they interfere with everyday activities, work or school.

0 Normal recognition of personal deficits and how they affect activities. "Normal" does not indicate perfect self-awareness since few, if any, people are this insightful. "Normal" means that limited self-awareness is expressed verbally or apparent in activities and relationships no more so than for most people.

1 Limited self-awareness is represented primarily by a tendency to minimize personal weaknesses. People at this level are generally aware of their deficits, compensate for them with relative consistency, and generally avoid situations in which their deficits will cause major problems.

2 People at this level generally are able to report deficits and may even consistently compensate for them with the use of a memory notebook or other techniques. However, they do not reliably anticipate the effect of cognitive and behavioral deficits in all situations. Consequently, limited self-awareness interferes with their interpersonal and other activities some of the time.

3 Impaired self-awareness affects many interpersonal interactions and activities. At this level, people may recognize their deficits to a degree and usually are able to report that they have "memory" or other cognitive problems. However, they typically do not anticipate how these deficits will interfere with their activities, or compensate for their deficits by using a memory notebook or other techniques.

4 Awareness of personal limitations is so impaired that it creates almost constant problems for people at this level in most of their interactions. Such people generally deny having any problems because of brain injury despite obvious impairments. At the extreme, they may even deny that they have a brain injury despite obvious physical as well as cognitive impairments.

21. Family/significant relationships: Interactions with close others. Describe stress within the family or those closest to the person with brain injury. "Family functioning" means cooperating to accomplish tasks that need to be done to keep the household running as well as providing mutual support. "Family" refers to close others living together or in close proximity and may represent either traditional and non-traditional "families."

0 Normal stress. Most families experience stress with some frequency, particularly as children deal with issues relating to dependence/independence or family members experience life stressors outside of the family. At this level, stress within the family is well within the family's ability to cope.

1 At this level, stress is significant enough to challenge the ability of members of the family to cope but does not result in sustained distress and does not significantly disrupt the family routine or maintenance of the household.

2 Family functioning is disrupted in some but not the majority of the time. Arguments or isolating oneself may be more frequent for family members. Meals and routine household chores are not completed consistently, potentially leading to additional stress and distress. However, family members feel that the situation can improve and are still able to be supportive of each other. Family counseling is an option but not clearly required.

3 Family routine, household functioning, and mutual support within the family are unsatisfactory to family members much of the time. Arguments and isolation occur frequently. Cohesion within the family is largely absent, or pathological to the point of enmeshment (i.e., inappropriate, unconstructive, or potentially destructive overinvolvement in each others' affairs). Family therapy is usually recommended.

4 At this level, the family is characterized by an almost complete lack of cohesion or obviously pathological enmeshment. Family therapy is clearly recommended.

22. Initiation: Problems getting started on activities without prompting. This item is meant to capture the lack of motivation or *abulia* characterizing some frontal lobe conditions. In some cases, reduced activity and lack of initiation may be due to psychological causes, such as, depression. Impaired initiation should be rated here if it is believed to be due to a neurologic rather than a psychologic condition.

0 Normal initiation of activities.

1 At this level, people may require an increased degree of prompting or encouragement to engage in conversation and other activities but their overall level of activity and participation is not significantly reduced. Self-directed compensatory mechanisms (i.e., cues, alarms, prompts) or medication may be used with the end result of a generally normal level of initiation and activity.

2 Prompting by another is required for initiation of behavior a some but not the majority of the time. Activity level is reduced overall. At this level, lack of initiation usually does not present safety concerns. It may limit vocational options but does not preclude community-based employment.

3 Prompting by another is required much of the time for the initiation of behavior. Lack of initiation may occasionally present safety concerns resulting from failure to initiate critical behaviors, such as, taking medications or preparing meals. Impaired initiation presents a significant obstacle to community-based employment.

4 At this level, people rarely initiate behavior without prompting even in interpersonal exchanges. Impaired initiation presents definite safety concerns and recommends supervision. Severely impaired initiation usually precludes community-based employment.

23. Social contact with friends, work associates, and other people who are not family, significant others, or professionals: The focus of this item is on the frequency of contacts and consistency of relationships with people who are not related to or have a professional relationship with the person with brain injury. The range for normal social activity at any age is relatively wide. Some people are temperamentally more introverted and maintain a small number of particularly close friends with whom they engage in activities regularly but infrequently. Others are more extroverted and have a large number of friends and acquaintances with whom they socialize almost daily. Typically the amount of social activity changes with age and family responsibilities. In rating this item, preinjury level of social activity may serve as an indicator of desired degree of social activity. As for most items, it is often difficult to obtain a clear idea of preinjury status which may be idealized by those being rated and their significant others. The satisfaction of the people being rated with their current social life is another potential indicator of the degree to which their social activity is "normal" for them.

0 Normal for age as suggested by frequency and consistency compared to other persons of this age, personal satisfaction, and time available considering work and family responsibilities.

1 Infrequent discomfort, limited initiation, or obstacles to socialization are reported. However, these are relatively rare and affect socialization less than 5% of the time. People at this level generally report overall satisfaction with their social life.

2 Discomfort, limited initiation, or other obstacles interfere with socialization some but not the majority of the time (< 25%). People at this level are more isolated or dependent on family and professional relationships than is appropriate for age. They may express a mild level of dissatisfaction with their social life.

3 Discomfort, limited initiation, or other obstacles interfere with socialization much of the time. Social activity other than with family and professionals is more the exception than the rule. People at this level are relatively isolated and may express significant dissatisfaction with their lack of social involvement.

4 Aside from socialization provided by family or professionals, social activities are very rare or non-existent. People at this level are socially isolated and may express marked dissatisfaction with their level of social activity.

24. Leisure and recreational activities: Rating this item is similar to that for Item 23 in that frequency, consistency, and satisfaction are considered in deciding to what degree leisure and recreational activities are "normal" for age. The degree of engagement in other activities and responsibilities should also be considered. For instance, it would be "normal" for people who are working full-time and have significant family responsibilities to be involved in fewer recreational pursuits than those with less work and family responsibilities. Leisure and recreational pursuits rated here are those that require a degree of physical or intellectual activity. For instance, watching old movies on television would not qualify for rating as a leisure/recreational activity unless the person were part of a club or group that regularly discussed old movies. Similarly reading would not qualify for rating under this item unless reading led to a less passive activity, such as, writing, discussion, vocabulary building, or research. Some recreational pursuits may be relatively isolated, i.e., painting, model building but would qualify because they require active engagement with the environment and produce something tangible.

0 Normal for age as suggested by frequency and consistency compared to other people the same age, personal satisfaction, and time available considering work and family responsibilities.

1 Infrequent discomfort, limited initiation, or obstacles interfere with leisure pursuits. However, these are relatively rare and affect leisure activities less than 5% of the time. Generally people at this level express overall satisfaction with their leisure time.

2 Discomfort, limited initiation, or other obstacles interfere with leisure activities some but not the majority of the time (< 25%). People at this level are less active than is appropriate for age. They may express a mild degree of dissatisfaction with their level of leisure interest and activity.

3 Discomfort, limited initiation, or other obstacles interfere with leisure activities much of the time. Active leisure involvement is more the exception than the rule. People at this level are relatively sedentary and may express significant dissatisfaction with their level of leisure interest and activity.

4 Leisure activities are very rare or non-existent at this level. People rated here are generally sedentary and may express marked dissatisfaction with their level of leisure interest and activity.

25. Self-care: Eating, dressing, bathing, hygiene. This item considers the amount of independence with which basic self-care activities are performed including eating, bathing, dressing, and other aspects of personal hygiene. In all ratings, performance must be acceptable in terms of societal standards. For instance, people being rated may routinely dress and groom themselves with no assistance from another person. However, if their appearance is disheveled and their grooming is incomplete, then they would not be rated as "0". In such cases, they should be rated according to the amount of assistance they would require in order for their performance to be acceptable.

0 Basic self-care activity is performed independently with a socially acceptable result. No assistance, prompting, or assistive devices are required to perform these activities.

1 Self-care is essentially performed independently with the use of assistive devices or an external system for prompts or cueing or less efficiently. At this level, people may perform these activities with greater effort or more slowly than most other people their age. If assistance or prompting is required from another person, this is infrequent (<5% of the time).

2 At this level, people require assistance from another person for self-care some but not the majority of the time (< 25%). Assistance includes prompting or cueing from another person.

3 Physical assistance, prompting, or cueing from another person is required much of the time for acceptable performance of basic self-care.

4 Physical assistance, prompting, or cueing is required all or almost all of the time for acceptable performance of basic self-care.

26. Residence: Responsibilities of independent living and homemaking (such as, meal preparation, home repairs and maintenance, personal health maintenance beyond basic hygiene, and medication management) but not including managing money (see #29). This item focuses on the amount of supervision that a person requires for maintaining their residence. This item mirrors the dimension defined by the Supervision Rating Scale (SRS).[4] A copy and more detail about the SRS is available at the COMBI web site (www.tbims.org/combi).

0 Living independently alone or with others. If living with others, people at this level do not receive supervision or special help from these others. They appear capable of living alone. They perform basic and instrumental activities of daily living without assistance and at an acceptable level, as indicated by an absence of concern about their independent living ability from themselves or others. Equivalent to a score of 1 or 2 on the SRS.

1 Although responsibilities of independent living and performance of activities of daily living (except money management) appear to be generally at an acceptable level, a degree of concern about safety or rare examples of difficulty in performance are reported. Equivalent to a score of 3 on the SRS.

2 Assistance or supervision is required a small proportion of the time, i.e., a few hours a day. Equivalent to a score of 4 or 5 on the SRS.

3 Assistance or supervision is required much of the time, i.e., more than 8 hours a day and enough that a special caregiver must be employed or a significant other is unable to work full-time outside the home. Equivalent to a score of 6 or 7 on the SRS.

4 Assistance or supervision is required virtually all the time. People scoring 8 or higher on the SRS would be rated at this level.

27. Transportation: Independence in moving oneself greater geographic distances. In rating this item, consider both ability to perform these activities without assistance as well as environmental limitations. For instance, some people may be able to use public transportation independently but public transportation is not available because they live in a rural area. In such cases, these people should be rated as needing assistance most or all the time because they cannot drive and automotive travel is the only option.

0 People at this level are able to use all forms of transportation safely and independently including a personal motor vehicle. They hold a valid driver's license for operation of a motor vehicle.

1 People at this level use all forms of transportation independently but others have concerns about their safety in these activities, usually regarding their driving ability. This category also includes people who are completely independent and safe in all forms of transportation except use of a personal motor vehicle because they have chosen not to drive or been restricted from driving.

2 At this level, people require a small amount of assistance with transportation, i.e., less than 25% of the time. They usually cannot or do not drive. They may need physical help or may need cognitive assistance, such as, help in arranging schedules and prompting or cueing to keep the schedule.

3 Physical or cognitive assistance is required for transportation much of the time. People at this level may have a few routine routes that they can manage independently but require assistance in negotiating transportation to all other locations. They cannot drive.

4 Physical or cognitive assistance is required for all or almost all transportation. They cannot drive.

28A. Paid employment. This category includes only work for pay. All other categories of productive activity are rated under 28A (Other employment). A person should be rated only once on either 28 or 28A but not on both. The person should be rated for the social role that appears primary as indicated by the relative amount of time devoted to the role and the value the person attaches to it. For instance, a working mother who works full time for pay would be rated under 28 (Paid employment). On the other hand, a working mother who chooses to work only part time for pay because she feels that her primary role is at home would be rated as a "homemaker" under 28A. A student who is working for pay primarily to support his or her activity as a student would be rated as a "student" under 28A. A person who is in rehabilitation in order to return to a valued social role would be rated on the primary role to which they wish to return. In other words, an unemployed person who is trying to find a job for pay would be rated under 28; the same person trying to return to school or homemaking would be rated under 28A. Except for the special case of retirement under age 60 (see below under 28A), the person who is being rated is the ultimate authority regarding the primary desired social role.

For both 28 and 28A, "support" for employment may be permanent or temporary and includes special assistance from another person such as a job coach or shadow, tutor, housekeeper, or other kind of helper including "natural" support from family, friends, and co-workers. "Support" also includes ongoing accommodations in terms of time such as a reduced work load (i.e., less productivity per unit time), extra time for some activities (for example, extra time for tests for students), longer or more frequent breaks, or other schedule modifications. "Support" does not include physical accommodations such as ramps, aids for seeing, or any of a number of one time modifications to the physical environment that facilitate employment.

0 This level is reserved for those working full time (30 or more hours per week) for pay in the community without support. There may be some local variation in what is considered "full-time" work. For instance, in some settings, people may be considered "full-time" employees but be restricted from working more than 28 hours per week because the employer is required to pay additional benefits if employment exceeds that amount. The definition for purposes of rating this item should reflect the local definition of "full-time" employment and is usually about 30 or more hours per week.

1 This level includes only part time paid employment in the community without support. Employment is considered part time that requires between 3 and 30 hours of work per week. People who are working very intermittently, that is, less than 3 hours per week on average, are considered "unemployed."

2 This level includes full- or part-time community based paid employment with support as defined above. Supports may be temporary or permanent.

3 This level includes only employment in a sheltered workshop.

4 If criteria are not met for any of the above categories, the person is considered "unemployed" and rated at this level.

28B. Other employment. This category includes formal schooling, volunteer work, homemaking, and people who are retired for age, that is, over 60. People who identify themselves as "retired" but are under age 60 are rated for their primary social role before "retirement." "Support" is as defined above under item 28.

0 This level includes:

- Independent homemaking in which "homemaker" is the primary social role and involves at least 30 hours of responsibility each week. In almost all cases, full time homemaking includes child rearing responsibilities or care of some other person such as a disabled parent.
- Full-time school, that is, carrying a full class load for age without special education, schedule adjustments, or other support.
- Independent volunteer work for more than 30 hours a week without special assistance or support. At this level, volunteer work is almost always chosen because the person has financial reserves and does not have to work for pay. People who wish to work for pay and are doing volunteer work because they have been unable to obtain paid employment should be rated as "unemployed" under 28.
- Retired, over age 60, but engaged in role appropriate activity more than 30 hours per week. Typically such activity is some combination of volunteer work, assisting children in raising their children, and organized personal enrichment or leisure activities with peers.

1 This level includes:

- Independent homemaking activities less than 30 hours per week but more than 3.
- Students carrying at least one course and engaged in academic activities at least 3 hours per week but not full time. Academic activities must be accomplished without special education or other support as previously defined.
- Independent volunteer work between 3 and 30 hours per week on the average.
- Retired above age 60 and involved in role appropriate activities between 3 and 30 hours per week.

2 This level includes engaging in any of the following activities <u>with support</u> at least 3 hours per week:

- Homemaking with regular support from paid help or a family member. "Support" in such cases must be above assistance that would normally be expected from a cohabiting spouse, relative, or partner.
- Full- or part-time school with special education services, tutoring, or other support.
- Volunteer work with special assistance or support.
- Retirement activities that are largely accomplished with support. An example would retired people primarily involved in leisure activities at a community retirement center that are orchestrated by staff at the retirement center.

3 This level includes accomplishing role-related activities in a supervised setting at least 3 hours per week, other than a sheltered workshop. For instance, people who are involved in volunteer or "homemaking" or leisure activities in the residential supervised living center in which they live. Persons working in a sheltered workshop should be rated under item 28.

4 Those for whom the desired social role is not paid employment but criteria are not met for any of the above categories in 28A are considered "unemployed" and rated at this level.

29. Managing money and finances: Shopping keeping a checkbook or other bank account, managing personal income and investments. For purposes of this item, "shopping" refers to the *use of money* in acquiring goods. Other aspects of shopping, i.e., acquiring sufficient goods to maintain the household are considered under "independent living." In rating this item, consideration is given to whether the amount of money being managed is small or large. People who are able to make small purchases with relatively small amounts of money for clothes, groceries or other personal items but would be at risk for managing larger amounts, unable to make prudent investments without assistance or vulnerable to being taken advantage of in managing larger personal finances would be rated at levels 3 or 4. Some people may be capable of managing their finances but do not because this duty is the responsibility of another person, often a spouse. In such cases, the rating should be based on their apparent capability.

0 Large and small amounts of money and personal finances are managed independently. Advice may be sought periodically about money management strategies from others or from professional advisors. However, seeking such advice does not appear to be essential to assuring prudent and appropriate use and management of personal finances.

1 Large and small amounts of money and personal finances are managed independently. However, others have concerns about the management of larger amounts of money and personal finances. People for whom concerns exist even about their management of small amounts of money are typically rated at levels 3 or 4.

2 At this level, people require a small amount of routine assistance in managing large amounts of money and their personal finances. For instance, they are able to take care of shopping and managing a check book but routinely consult about management of investments and longer term financial decisions with a trusted advisor or paid consultant. This consultation appears to be critical to their prudent management of their finances.

3 Assistance is required much of the time in managing both small and large amounts of money. Typically at this level people cannot independently manage a checkbook and require assistance in making most significant purchases. They require assistance in managing a savings program and in all long term financial decisions. Nonetheless they are independent and require no help in making small purchases.

4 At this level, people require assistance in virtually all but the simplest activities using money. For instance, their use of money may be limited to making a few independent purchases involving small amounts. Even in such situations, they are usually unable to count change reliably and will use alternative strategies (such as, carrying exact amounts for purchases). Typically at this level, another person such as a conservator or guardian, has legal authority over their finances.

Pre-existing and Associated Conditions

Items included in this next section do not contribute to the total score or subscale scores for the MPAI because they do not represent direct or typical outcomes of ABI. Rasch analyses have demonstrated that these items do not "fit" with the previous items in defining a measure of outcome after brain injury.

Nonetheless, these six additional items define factors that are important to consider in planning rehabilitation or other interventions with people after ABI. The presence of any of these factors may indicate that the person being evaluated requires more extensive rehabilitation services (for instance, a person who has both a spinal cord injury and a brain injury), special needs for supervision (a person with Alzheimer's Disease who also sustained a brain injury), or additional treatment (a person with a pre-existing substance abuse problem or with co-existing severe psychiatric symptoms).

Because it is often difficult or impossible to accurately determine functional capacities before injury, comparisons with preinjury status are avoided in rating the 29 items for brain injury outcome included in the MPAI. However, for these additional items, rating both pre- and post- injury status should be attempted since whether the condition existed before the injury occurred or emerged after the injury may be an important consideration in determining treatment recommendations.

30. Alcohol Use: Use of alcoholic beverages both before and after injury. Although the absolute quantity of alcohol consumption may be a factor in determining whether use is a problem, the primary factor is the degree to which alcohol use interferes with everyday functioning, accomplishing social role activities, or is medically contraindicated. For instance, one person may have a drink or two every day with no undesirable medical or social effect; whereas, another may experience negative effects or put themselves at medical risk with only an occasional drink.

0 Use of alcohol is associated with no medical risk and results in no negative consequences.

1 At this level people infrequently overuse alcohol or binge drink but this is not a pattern, is associated with no medical risk, and results in no regular negative consequences for them or close others. People with a past history of alcohol abuse or dependence who are currently maintaining sobriety and in remission or under active treatment are also rated at this level. For active users, intervention at this level is usually appropriately educational and supportive or directed at addressing the primary condition (such as, anxiety, depression, marital discord) that is contributing to substance abuse.

2 There is a strong suspicion that overuse or binge drinking occurs relatively frequently and is interfering with social role responsibilities. The pattern of alcohol use raises concern about possible dependence and recommends further evaluation for possible treatment.

3 There is a clear pattern of dependence or binge drinking that requires further outpatient treatment or other organized intervention.

4 There is a clear pattern of dependence or binge drinking that requires inpatient or residential treatment.

31. Drug Use: Use of illegal drugs or abuse of prescription drugs both before and after injury. As for alcohol use, an important factor in making this rating is the degree to which drug use interferes with everyday functioning or accomplishing social role activities. However, any use of illegal drugs or of prescription drugs outside of medically recommended use is considered a problem.

0 No use of illegal drugs; prescription drug use according to medical recommendations. Some people use prescription drugs according to medical recommendations but have clearly manipulated the system to obtain prescription drugs (for instance, obtaining multiple prescriptions for multiple providers for benzodiazepine medication). These people would be rated at a higher level even though technically they are using the medication "according to prescription."

1 At this level, people use illegal drugs or abuse prescription drugs infrequently but this is not a pattern, is associated with no medical risk, and results in no regular negative consequences for the person or close others. Examples are the teenager who infrequently uses marijuana or the person who occasionally takes an extra dose of tranquilizing medication under stress. People with a past history of drug abuse or dependence who are currently maintaining sobriety and in remission or under active treatment are also rated at this level. For active users, intervention at this level is usually appropriately educational and supportive or directed at addressing the primary condition (such as, anxiety, depression, marital discord) that is contributing to substance abuse.

2 There is a strong suspicion that use of illegal drugs or possible abuse of prescription medication is occurring relatively frequently and is interfering with social role responsibilities. There is concern about possible dependence. Further evaluation for possible treatment is recommended.

3 There is a clear pattern of dependence or abuse that requires further outpatient treatment or other organized intervention.

4 There is a clear pattern of dependence or abuse that requires inpatient or residential treatment.

32. Psychotic symptoms: Hallucinations, delusions, other severe distortions of reality. The degree to which such symptoms were present before injury and are present after injury should be rated. This category is for more classical psychiatric symptoms and should not be used for perceptual distortions or poor conceptualizations of reality resulting primarily from cognitive impairment or impaired self-awareness due to brain injury. These should be rated under the appropriate previous MPAI items. Symptoms in this category are typically associated with a psychiatric diagnosis in the schizophrenic spectrum, Paranoid Disorder, or severe Borderline Personality. In rare cases, such symptoms may appear to be the direct result of brain injury and cannot be entirely explained by cognitive impairments rated previously.

0 No symptoms.

1 Symptoms may have been present before or after injury but are controlled with current treatment or have remitted. At this level, symptoms may occur but do not interfere with everyday functioning. For instance, people at this level may hold a fixed delusion, such as, that Martians have taken over the bodies of all high government officials, but recognize that no one else believes this and keep this belief to themselves because they realize that people will think they are crazy if they share it.

2 Symptoms emerge infrequently and very occasionally interfere with social relationships or social role responsibilities. However, symptoms are managed as well as is possible with current treatment and no additional evaluation or treatment is recommended.

3 Symptoms are frequent or sufficiently severe that they interfere significantly with social relationships and social role responsibilities. Further evaluation for treatment is recommended

4 Symptoms are severe and acute and require inpatient treatment. Typically at this level symptoms create a substantial risk to the person or to others.

33. Law violations: Pre or post injury history of conviction for legal infractions.

0 No history of law violations or conviction only for minor traffic violations (such as, rare speeding or parking violations).

1 Conviction for no more than two misdemeanors other than minor traffic violations.

2 Conviction for more than two misdemeanors other than minor traffic violations.

3 A single felony conviction.

4 Multiple felony convictions.

34. Other conditions causing physical impairment: Physical effects of other conditions that were present prior to brain injury, resulted from nonbrain injuries, or occurred after the injury. Examples are spinal cord injury, amputation, and many other diseases and conditions that result in physical impairment. The physical impairment should not be either the direct or indirect result of the brain injury. For instance, impairment associated with a "stroke" (that is, disruption of the cerebral blood supply) due to brain trauma should be rated under the appropriate items in the first 29 items of the MPAI and not given an additional rating here. However, if the person had a stroke before or after the injury, impairment associated with that event would be rated here. The general impact of these additional injuries or illnesses on physical functioning both before and after brain injury are rated on the standard scale used for impairment rating in the MPAI:

0 No physical problems or difficulties due to nonbrain injury condition.

1 Physical impairment is present but does not interfere with everyday functioning. At this level, people may use medication or an assistive device to accommodate for the problem.

2 Physical impairment interferes with activities and everyday functioning some but not the majority of the time. At this level people require assistance in the performance of physical activities less than 25% of the time.

3 Physical impairment interferes with activities much of the time. People at this level require assistance in the performance of physical activities 25 to 75% of the time.

4 Physical impairment interferes with all or almost all activities. People at this level require assistance in the performance of physical activities more than 75% of the time.

35. Other conditions causing cognitive impairment: Cognitive effects of other conditions that were present prior to brain injury, resulted from nonbrain injuries, or occurred after the injury. Examples are Alzheimer's disease or other dementia, anoxia, or many other diseases and conditions that result in cognitive impairment. The cognitive impairment should not be either directly or indirectly due to the brain injury. For instance, impairment associated with a anoxia occurring during the injury should only be rated if it is believed that cardiopulmonary arrest resulted in cognitive problems that are clearly more than can be attributed to the brain injury alone. If uncertainty exists, err on the side of attributing cognitive problems to the brain injury and do not make any additional rating here. This item was included to identify those people who clearly have another brain condition that results in cognitive impairment and, in many cases, is the primary contributor to cognitive impairment. An example is someone who was in a nursing home with Alzheimer's disease prior to injury, had a mild brain injury due to a fall, and now has returned to the nursing home with essentially the same level of cognitive impairment as prior to injury. The general impact of these additional injuries or illnesses on cognitive functioning both before and after brain injury are rated on the standard scale used for impairment rating in the MPAI:

0 No cognitive problems or difficulties due to conditions unrelated to the brain injury.

1 Cognitive impairment is present but does not interfere with everyday functioning. At this level, people may use medication or an assistive device to accommodate for the problem.

2 Cognitive impairment interferes with activities and everyday functioning a some but not the majority of the time. At this level people require assistance in the performance of cognitive activities or communication less than 25% of the time.

3 Cognitive impairment interferes with activities much of the time. At this level people require assistance in the performance of cognitive activities or communication 25 to 75% of the time.

4 Cognitive impairment interferes with all or almost all activities. At this level people require assistance in the performance of cognitive activities or communication more than 75% of the time.

SCORING, REFERENCE DATA,

AND TEST INTERPETATION

Scoring

Use the scoring sheet at the end of the MPAI-4 form to assist in scoring. First, score each of the subscale Indices.

For the **Ability Index**, item 4 (Audition) must be rescored. If the original score for item 4 was 0, then the new score also is 0; if the original score was 1, 2, or 3, then the new score is 1; if the original score was 4, then the new score is 3. Place the new score for item 4 in the column for summing scores. Then sum the raw scores of the other items contributing to the Ability Index, that is, items 1-3 and 5-12. Use only the highest score from either 7A or 7B. Add sum of these scores to the new score for item 4 to obtain the total raw score for the Ability Index. Place this raw score sum in the appropriate blank at the bottom of the scoring sheet.

For the **Adjustment Index**, item 16 (Pain and headache) must be rescored. If the original score for item 16 was 0, then the new score is also 0; if the original score was 1 or 2, then the new score is 1; if the original score was 3 or 4, then the new score is 2. Place the new score for item 16 in the column for summing scores. Then sum the raw scores of the other items contributing to the Ability Index, that is, items 13-15 and 17-24. Add the sum of these scores to the new score for item 16 to obtain the total raw score for the Adjustment Index. Place this raw score sum in the appropriate blank at the bottom of the scoring sheet.

For the **Participation Index**, both items 27 (Transportation) and 28A/B (Employment) must be rescored. Rescoring is different for each of these items. For item 27, if the original score was 0 or 1, then the new score is 0; if the original score was 2 or 3, then the new score is 1; if the original score was 4, then the new score is 3. Place the new score for item 27 in the column for summing scores. For item 28, only 28A or 28B should have been rated. Use the original score for the part of item 28 that was used. If the original score for item 28 was 0, then the new score is also 0; if the original score was 1 or 2, then the new score is 1; if the original score was 3 or 4, then the new score is 3. Place the new score for item 28 in the column for summing scores. Next sum the raw scores of the other items 22-24. Note that these items contribute both to the Adjustment Index and the Participation Index. Place the sum of items 22-24 in the summing column for the Participation Index and in the appropriate blank at the bottom of the scoring sheet. Next, sum the remaining items for the Participation Index (that is, item 25, 26, and 29). Place this sum in the scoring column and obtain the total sum by adding the new scores for items 17 and 28, the sum of items 22-24, and the sum of items 25, 26, 29. Place this raw score sum for the Participation Index in the appropriate blank at the bottom of the scoring sheet.

Finally, at the bottom of the scoring sheet, obtain the Full Scale score for the MPAI-4 by adding the raw score sums for the Ability Index, Adjustment Index, and Participation Index and then subtracting the sum of items 22-24. (The sum of items 22-24 must be subtracted once because it has been used in both the Adjustment Index and the Participation Index.

Raw scores inventories completed by staff for the Full Scale MPAI-4 score and each of the subscale Index scores can be converted to T-scores using Tables in the Appendices with reference to either the National

sample (Appendix I) or the Mayo sample (Appendix II). Reference data for T-score conversions for inventories completed by people with ABI (Appendix III) or SO (Appendix IV) are available only for the Mayo sample. Procedures for T-score conversion are described in more detail in the next section of this manual.

Reference data

Data are available from two samples for comparison purposes. These data sets were both obtained for people with ABI and, as such, do not represent true "normative" data, that is, these data are not referenced to a non-ABI sample. Data for the first larger (n=386) National sample was obtained from staff ratings of

Table 2: National sample characteristics (n = 386)

Gender:	Male Female	73% 27%
Age (years):	Mean = SD = Median = Interquartile range = Range =	38.0 12.4 38.0 29.0-47.3 14 to 77
Time since injury (years):	Mean = SD = Median = Interquartile range = Range =	6.9 7.5 5.0 1.1 to 10.0 0 to 40
Race:	African American Asian/Pacific Is. Caucasian Hispanic Native American Other	07 % 02 % 80% 06% 02% 03%
Education:	<12 years 12-15 years ≥16 years	23% 66% 11%
Type of injury:	TBI CVA Other	88% 6% 6%
Severity:	Mild = Moderate = Severe = Undetermined =	05% 29% 39% 26%
Geographic location:	Southeast Midwest Southwest/Mntn California	30% 28% 21% 21%

people with ABI served through the Learning Services Corporation, Rehab Without Walls and Mayo-Rochester. Characteristics of this National sample are described in Table 2. Data for the second sample for people evaluated only at Mayo-Rochester includes ratings made by staff, people with ABI, and their SO. Characteristics of the Mayo sample are described in Table 3.

Following scoring of the MPAI-4, raw scores for staff ratings may be converted to T-scores with reference to either the National or the Mayo sample or both. Tables for T-score conversion referenced to the National sample are provided in Appendix I. Reference data for MPAI-4 raw scores obtained from inventories completed by people with ABI and their SO are available only for the Mayo sample. Tables for T-score conversion referenced to the Mayo sample are provided in Appendix II-IV.

T-score conversion is accomplished simply by finding the raw score for the Full Scale or subscale Index in the appropriate Tables in the Appendices and recording the T-score next to the raw score. T-scores have a mean of 50 and a standard deviation of 10 with reference to the sample on which they are based.

Table 3: Mayo sample characteristics (n = 134)	
Gender	61% male 39% female
Race	92% white 8% non-white (African American, Native American, Hispanic, mixed)
Education	18% less than HS, HS with spec ed, GED 51% high school degree, high school + some college 31% college degree, advanced degree
Type of injury	65 % traumatic (TBI) 15% cerebrovascular accident, other vascular 8% resected tumor 5% encephalitis, infection 7% other (including anoxia, toxic exposure, multiple sclerosis)
Severity of TBI (n = 87)	29% mild 12% moderate 44% severe 15% unknown
Age	Mean = 38.8 yrs SD = 13.5 yrs Mdn = 38 yrs Range = 17-77 yrs
Time since injury/ Onset	Mean = 5.3 yrs SD = 8.4 yrs Mdn = 1.8 yrs Range = 1 mo – 43.4 yrs

Test interpretation: Case examples. Interpretation of the results of the MPAI-4 is straightforward. Ratings reflect actual behaviors and restrictions of interest to rehabilitation. Scoring and use of T-scores, contrasting results of subscale Indices, and comparing results obtained from people with ABI, their SO, and staff may inform the rehabilitation planning process, as the following case illustrate.

Case #1 is a 25 year old woman named Jane who was injured in motor vehicle accident. In addition to lower extremity fractures, she sustained a relatively severe traumatic brain injury with an initial Glasgow Coma Scale of 8, coma lasting about 1 week, and initial head CT scan showing multiple cerebral contusions and small hemorrhages.

She was seen for an initial rehabilitation evaluation about 9 months after her injury by an outpatient team that included a rehabilitation physician, a neuropsychologist, a PT, and an OT. Completing the MPAI-4 by consensus, this team rated her in the mild-moderate range on the Ability Index (raw score = 12;

National T-score = 42; Mayo T-score = 46) noting mild problems with hands, nonverbal communication, and novel problem-solving, and more significant problems with attention and memory. Social and emotional adjustment, self-awareness, and family support were judged to be relatively good, resulting in a low score on the Adjustment Index (raw score = 7; National T-score = 35; Mayo T-score = 30). Restrictions were noted on the Participation Index, however, in social and recreational involvement, independent living, transportation, and money management. Jane was also unemployed. Her score on the Participation Index was also in the mild to moderate range (raw score = 17; National T-score = 46; Mayo T-score = 51).

Outpatient rehabilitation and community-based services were organized that focused on developing methods to compensate for cognitive problems, primarily through use of a "memory notebook," as well as in a number of functional areas that included increasing social and leisure activities, independent living and money management skills, and vocational rehabilitation. Re-evaluation with the MPAI-4 was done periodically throughout this process to assess progress.

After 6 months of outpatient rehabilitation and community services, Jane had greatly increased her social activities and was living and working in the community. Scores on the MPAI-4 documented a little improvement on the Ability Index (raw score = 8; National T-score = 37; Mayo T-score = 39) but more dramatic improvement on the Participation Index (raw score = 2; National T-score = 25; Mayo T-score = 29). Jane had re-engaged with her community despite her remaining cognitive and physical impairments.

Case #2 is a 46 year old man named Ralph who sustained a mild TBI. He collided with another player in a softball game and was briefly unconscious (a few minutes) and experienced a period of post-traumatic amnesia lasting about a half hour. He was taken to a hospital Emergency Room where head CT scan was normal and he was dismissed to home without hospitalization. Ralph worked as a software developer in a relatively intense environment with high demands for productivity and meeting deadlines. He attempted to return to work after his injury but was unable because of problems with memory and frequent severe headaches.

He was evaluated by a rehabilitation physician and a neuropsychologist who also conducted neuropsychometric testing. The physician and neuropsychologist coalesced their assessments of his case by completing the MPAI-4 together. They found little impairment on the Ability Index (raw score = 3; National T-score = 25; Mayo T-score = 27), noting mild problems with attention that probably accounted for Ralph's experienced "memory" problems. Neuropsychometric test results were generally within normal limits except for mild variability indicating difficulty sustaining attention and mild impairment on the more demanding attentional tasks. A number of indicators on the Adjustment Index were elevated (raw score = 24; National T-score = 54; Mayo T-score = 55). Ralph appeared depressed, anxious, and irritable. He experienced frequent headaches and fatigue. The doctors debated to what degree difficulties with attention represented the residuals of mild TBI vs. the effects of depression, headache pain, and associated sleep disturbance and fatigue. Although his symptoms appeared genuine, he was very focused on them and this increased his distress. All these factors interfered with his family and social life and with his participation in leisure activities. However, with the exception of mild limitations in social and recreational activities and being currently unemployed, Ralph was generally participating fully in areas measured by the Participation Index (raw score = 8; National T-score = 40; Mayo T-score = 41).

Planned intervention focused on medical treatment of depression and headache, and psychological treatment to address adjustment issues, including vocational reassessment, and coping with stress. Ralph's family was involved in a number of these psychotherapy sessions. After several months of treatment, emotional and social adjustment problems had resolved. Headache and intermittent attentional problems remained but not at a level that interfered with everyday functioning. Ralph started his own software company in which he was able to work from home at his own pace. His old employer was one of his primary customers, contracting with Ralph for the development of software components that were a specialty for him. Re-evaluation with the MPAI-4 at dismissal from outpatient services revealed all T-scores below 30.

Case #3 is a 31 year old man, John, who sustained a severe traumatic brain injury (initial Glasgow Coma Scale = 8; coma X 2 weeks; multiple areas of hemorrhagic contusion on head CT) in the context of multi-trauma. He had a history of alcohol dependency prior to his injury and his wife, Mary, is concerned about his current use of alcohol.

John was evaluated about three years after his injury by a multidisciplinary rehabilitation team who completed the MPAI-4 by consensus. Staff noted relatively severe problems in most areas reviewed by the MPAI-4 resulting in T-scores above 60 on all three Indices using Mayo norms. As part of this evaluation, John independently completed the MPAI-4 as did his wife. One of the issues raised by staff in rating the MPAI-4 was impaired self-awareness. Consistent with this observation, John rated himself much lower in most areas. T-scores for Mayo norms for John's completion of the MPAI-4 were all below 40. His Mary's ratings on the MPAI-4 resulted in scores in between John's and the staff's ratings, that is, T-scores in the 50s on the Ability and Adjustment Indices and of 48 on the Participation Index. Mayo norms were used in computing these T-scores because norms are available for this sample for the MPAI-4 completed by people with ABI and SO as well as by Staff.

The higher scores on the Participation Index by staff compared to scores from John and Mary suggest that staff may have overestimated the degree to which John's community participation was limited. Nonetheless, there was little question that John was struggling with a complex array of physical and cognitive impairments, emotional, social and other adjustment issues, and had not been successful to-date in returning to many usual social, leisure, and vocational activities in the community. The rehabilitation team recommended that John enroll in an intensive day treatment program. Participation in this rehabilitation program was coordinated with intervention and recommendations from substance abuse specialists. Despite his initial objections, John agreed to this type of treatment with pressure from his wife, After about a month in the program appeared to develop enough awareness of how some of the impairments that had resulted from his injuries interfered with social and vocational adjustment. He resisted participating in formal substance abuse treatment. However, with support from the rehab team, his wife became more assertively insistent about and supportive of John's not drinking. With only a few short relapses in the course of the program, John appeared to maintain sobriety.

Following about 6 months of day treatment, John started a job in the community with ongoing support. He was compensating for his cognitive problems and his wife felt that his communication and behavior in social settings and with her were much improved. John, Mary, and rehabilitation staff independenttly completed the MPAI-4 again at the end of the program. All T-scores from all raters were between 40 and 50. John's status had improved significantly from the perspectives of his wife and the rehabilitation staff, and all parties appeared more "on the same wavelength" than before the program.

MPAI DEVELOPMENT AND PSYCHOMETRIC CHARACTERISTICS

Development

In 1987, Lezak[5] developed the original Portland Adaptability Inventory to provide a scale for meaningful documentation of the variety of behavioral and social challenges that face many persons with acquired brain injury (ABI). Malec and Thompson[6] subsequently refined this instrument, adding items for rating pain and specific areas of cognitive impairment. The resulting scale, the Mayo-Portland Adaptability Inventory (MPAI), consisted of item rating categories that focused on current functional ability without reference to pre-injury level.

Reflecting World Health Organization (WHO) distinctions[7, 8] between impairment, activity, and participation, ratings on most of the original MPAI items were designed to indicate whether performance is (a) within normal limits, (b) mildly limited but not to a degree that interferes significantly with everyday functioning (impairment only), or (c) sufficiently limited that it does interfere with everyday functioning to varying degrees (restriction of activity and participation). This rating scheme could be applied to most MPAI categories. However, those items that measure participation in the community, such as, employment or independent living, did not lend themselves well to this rating system and were scaled in terms of extent of participation. The rating scale was further modified in subsequent versions to maximize the internal consistency of the measures and to acquire information on problems that may have been present before as well as after ABI.

Previous versions of the MPAI include the original MPAI, the MPAI 2.3, and the MPAI-3. Analyses of sequential versions of the MPAI are described in greater detail in subsequent sections of this manual. The MPAI 2.3 expanded the rating scale for each item from 4 levels to 6 levels. Analyses of MPAI 2.3 data revealed that a 5 level rating system was sufficient and this was used in the MPAI-3. The MPAI-3 also added items to better represent the types of problems frequently found for people with milder ABI (such as, fatigue, dizziness, and sensitivity to mild symptoms). Analysis of MPAI-3 data led to recommendations for rescoring a few items to improve their "fit" with the overall measure. These analyses resulted in the MPAI-4.

Rating instructions for MPAI-4 items were also clarified on the form itself and provided in more detail in this manual. Rating for the Communication item and the Employment item were elaborated by splitting these items into two sections. Verbal and Nonverbal Communication for the Communication item, and Paid and Other Employment for the Employment item. Because it was infrequently used and did not fit well with the overall measure, the Childrearing item from the MPAI-3 was dropped as a separate item but included as an option under Other Employment. Specific subscales (Ability Index, Adjustment Index, Participation Index) were identified through analyses of MPAI-3 data. For the MPAI-4, items were rearranged for presentation in an order that corresponds to these subscales. The rating system for the MPAI-4 is based on analyses of the MPAI-3. Consequently reference data (see previous section) obtained with the MPAI-3 may be used to compare a specific person with ABI with other people with ABI on the overall MPAI-4 measure and each subscale.

Rasch analyses has been used as a primary method for evaluating and improving the MPAI. Nonetheless evaluation of psychometric properties reported subsequently also include more traditional psychometric indicators. Rasch analysis provides a method to evaluate, not only how well the items contributing to a measure represent the underlying measure, but also how well these items provide a range of indicators

that reliably differentiate among people rated with the measure. *Item fit* provides an indicator of how well each item serves these functions. Rasch fit statistics are based on the squared residual values of expected minus actual values of an item. *Infit* provides more weight to actual values closer to the item's expected value. *Outfit* provides an index of the influence of outliers. For this reason, Infit is generally felt to be the more critical indicator. In developing the MPAI-4, information gained from Rasch analyses guided our selection of items and the development of rating and scoring procedures that maximized item fit.

Other important indicators for Rasch analysis are Reliability and Separation. *Person reliability* indicates the degree to which items distinguish among people in a consistent manner. *Item reliability* indicates the degree to which items relate to each other in a consistent way for different people. The maximum possible reliability in either case is 1.00. For most measures, Person Reliability over .80 and Item Reliability over .90 is desirable. *Separation* provides another indication of how well a scale measures. Separation describes the extent to which items distinguish among people (*Person Separation*) and are distinct from each other (*Item Separation*). In Rasch analysis, a Separation of at least 2 is desired.

A major advantage of Rasch methods over traditional psychometric methods is that Rasch analyses evaluate whether the measure provides a reliable assessment of the full range of the characteristic being measured. Rasch analysis also evaluates whether items reliably distinguish among people at these various levels. By contrast, using traditional psychometric methods, a summary test score may have a high degree of internal consistency and reliability because the contributing items are largely redundant. Such a test score may appear valid in that it correlates relatively well with other similar scores. However, such a score will not include items that are sensitive to people at the extremes of the dimension of interest. Rasch analysis encourages the selection of a few items that represent the extremes of the measurement dimension but which, because they represent extreme values for the measurement domain, may not correlate highly with the overall measure. More extensive presentation of Rasch analysis may be found in Wright and Masters,[9] Linacre,[10] and Bond and Fox.[11]

Reliability

Reflecting the WHO nosology, development of the MPAI has been based on the assumption that an accurate characterization of persons with ABI and outcomes requires assessment of key indicators of *impairment, activity*, and *participation*. Rating scale (Rasch) analyses of sequential versions of the MPAI have supported this model.

MPAI. By examining the relationship of individual items to the underlying measure, Rasch analysis provides an assessment of the internal consistency or reliability of a measure. Rasch analyses of 305 Staff forms of the original MPAI completed as part of outpatient rehabilitation evaluations demonstrated that items relevant to each of the domains of *impairment*, *activity*, and *participation* form a single dimension in relationship to the level of overall severity of negative outcome after ABI.[12] These analyses also demonstrated satisfactory internal consistency (Person Reliability = .82; Person Separation = 2.12; Item Reliability = .99; Item Separation = 9.33). A Rasch analysis of the MPAI completed by people with ABI (Self MPAI) also showed satisfactory reliability for a scale constructed from the same items as the Staff MPAI.[13] Person Reliability for the Self MPAI was .84 (Person Separation = 2.29) and Item Reliability was .94 (Item Separation = 4.82).

MPAI 2.3. Although initial analyses indicated satisfactory reliability for the MPAI, we believed that the reliability could be improved by further refinement of the item rating scales. To accomplish this, we developed a modification of the MPAI, the MPAI 2.3. The MPAI 2.3 used a 6-point rating scale throughout. Some items in the original version (specifically, Psychotic Symptoms, Alcohol Use, Drug Use, Law Violations) were found not to contribute specifically to the measurement of the outcome of ABI. These items were retained at the end of the MPAI 2.3 because, when present, they offer information that is important in developing service plans. However, these items do not contribute to the MPAI score because they are not specific measures of ABI sequelae or outcome.

Rasch analyses of the MPAI 2.3 for 126 cases from the Mayo Medical Center and Bancroft Rehabilitation in Louisiana[14] showed excellent Person Reliability (.92), Person Separation = 3.49, Item Reliability (.95) and Item Separation (4.54). A 5-point scale appeared to best represent the range of individual item ratings. Further analysis of this same data set found that traditional indicators of item reliability, that is, item-to-scale point biserial correlations were in the moderate to strong range (i.e., most point biserial correlations between individual items and the overall measure ranged from .57 to .84 with a median of .69).

Following Rasch analysis, we conducted a principal components analysis of residuals. A principal components analysis of residual item variance (left after variance accounted for by the primary Rasch dimension is remoed) helps determine if a scale is measuring more than one construct. The principal components analysis suggested two subscales. One subscale, the *Physical/Cognitive Impairment Scale*, consisted of 11 items for Mobility, Use of Hands, Vision, Audition, Motor Speech, Communication, Attention/Concentration, Memory, Fund of Information, Novel Problem-solving, and Visuospatial Abilities. The *Physical/Cognitive Impairment Scale* itself demonstrated good reliability and separation (Person Reliability = .88; Item Reliability = .97; Person Separation = 2.66; Item Separation = 5.56). The second subscale, the *Social Participation Scale*, consisted of 10 items for Initiation, Inappropriate Social Interaction, Impaired Self-awareness, Family/Significant Relationships, Social Contact, Leisure/Recreation, Self-cares, Residence, Transportation, and Work/School. The *Social Participation Scale* also possesses good internal reliability and separation (Person Reliability = .86; Item reliability = .95; Person Separation = 2.46; Item Separation = 4.17).

Despite the indication from principal components analysis of a degree of independence for these two subscales, the MPAI 2.3 *Physical/Cognitive Impairment Scale* and *Social Participation Scale* were highly correlated (r = .75). The principal components analysis was of item variance remaining after the variance corresponding the overall measure identified through Rasch analysis was removed. Although this analysis suggested that more specific item clusters (subscales) provide additional information to the overall measure, the dimension described by the overall measure was very strong and accounted for most of the variance. Consequently subscales were highly correlated. In examining the relationship of the subscales to each other and the overall measure, the *Physical/Cognitive Impairment Scale* appeared to better represent the severe end of the continuum. The *Social Participation Scale* better represented the mild end with both scales having some items in the mid-range. Thus, these two subscales appear to measure different levels of the same underlying construct of long-term outcome after ABI. A third subscale, the *Pain/Emotional Disorder Scale*, also was suggested in the analyses. However, even though the Pain/Emotional Disorder Scale appeared to contribute information distinct from the other subscales, it included only 4 items and lacked sufficient internal consistency for formal scoring.

MPAI-3 & MPAI-4. Analyses of the MPAI 2.3 resulted in further refinements and development of a subsequent version of the measure, the MPAI-3. New items (Fatigue, Dizziness, Sensitivity to Mild Symptoms, and Financial and Money Management) were added to this version to represent better the milder end of sequelae of ABI.

National sample. Rasch analysis of the MPAI-3 based on 386 cases from a geographically diverse sample of persons with ABI receiving services through Learning Services Corporation, Rehab Without Walls, and Mayo Clinic confirmed the internal consistency of this version.[15] This analysis resulted in the elimination of the Child Rearing item because of its low utilization and minimal contribution to defining the measure. This analysis also demonstrated that recoding four items (Audition, Work/School, Transportation, and Pain) resulted in a better fit of these items to the total measure. With recoding of these four items, the 29-item measure revealed acceptable Infit and Outfit statistics (less than 1.4) for all 29-items (actual range .5 to 1.38) and satisfactory overall Person and Item Reliability and Separation for the measure (see Table 4). Other changes were made to clarify item ratings resulting in the current version of the MPAI—the MPAI-4.

Table 4: Rasch indicators of reliability and separation for MPAI-4 and subscales based on national sample (n=386)

Scale/subscale	Person Reliability	Person Separation	Item Reliability	Item Separation
MPAI-4: 29-item Measure	.88	2.68	.99	10.80
Ability	.78	1.88	.99	11.94
Adjustment	.79	1.96	.99	8.42
Participation	.78	1.89	.98	7.59

Mayo sample. MPAI-4 scoring procedures were applied in a sample of 134 people with ABI seen for outpatient rehabilitation evaluations at Mayo Clinic, Rochester, MN.[16] For most of these cases, data were available for the inventory completed by people with ABI and an SO as well as by rehabilitation staff. Person and Item Reliability and Separation indicators were generally acceptable for the Full Scale and subscale Indices representing items rated by each of these rater groups (Tables 5-8). A Rasch procedure called Facets analysis[10] allows for the examination and development of measures based on multiple raters sources. Facets analysis was applied to the Mayo data and resulted in MPAI-4 Full Scale and Indices that represented a composite of ratings from all three rater groups. Reliability and Separation indicators for the 3-rater composite for the MPAI-4 Full Scale and Indices are also provided in Tables 5 through 8.

Using this sample, we also examined inter-rater agreement among the three rater groups (Table 9). Agreement was generally within acceptable limits for most items, providing further evidence of the reliability of the inventory. Substantial differences, however, were also found among the three rater groups in the mean ratings and reliablities of subscales as well as on individual items. These differences reflect types of rater bias that are important for understanding the rehabilitation and psychosocial needs of people with ABI and their SO.

Table 5: Full Scale: reliability and separation (Mayo sample; n =134)				
	Person Reliability	**Person Separation**	**Item Reliability**	**Item Separation**
Person with ABI	.92	3.31	.96	4.97
SO	.92	3.37	.94	3.84
Staff	.86	2.49	.98	6.81
3-Rater Composite	.94	3.86	.99	11.06

Table 6: Ability Index: reliability and separation (Mayo sample; n =134)				
	Person Reliability	**Person Separation**	**Item Reliability**	**Item Separation**
Person with ABI	.84	2.30	.97	5.66
SO	.84	2.31	.93	3.68
Staff	.81	2.09	.98	6.72
3-Rater Composite	.86	2.52	.99	12.99

Table 7: Adjustment Index: reliability and separation (Mayo sample; n =134)				
	Person Reliability	**Person Separation**	**Item Reliability**	**Item Separation**
Person with ABI	.89	2.85	.92	3.29
SO	.86	2.43	.89	2.88
Staff	.76	1.79	.97	6.08
3-Rater Composite	.90	3.03	.97	5.74

Table 8: Participation Index: reliability and separation (Mayo sample; n =134)				
	Person Reliability	**Person Separation**	**Item Reliability**	**Item Separation**
Person with ABI	.74	1.70	.97	5.70
SO	.82	2.15	.97	5.50
Staff	.85	2.41	.99	8.17
3-Rater Composite	.89	2.80	.99	9.80

Table 9: Percent exact agreements and agreements within 1 point between rating groups on individual items (Mayo sample; n =134)

Items	People with ABI and SO		SO and Staff		People with ABI and Staff		All Rater Pairs	
	Exact	+/-1	Exact	+/-1	Exact	+/-1	Exact	+/-1
1. Mobility	51%	86%	41%	88%	44%	75%	45%	83%
2. Hands	50%	83%	43%	82%	45%	71%	46%	78%
3. Vision	59%	90%	54%	87%	50%	88%	54%	88%
4. Audition	67%	91%	76%	90%	67%	84%	70%	88%
5. Dizziness	49%	85%	34%	73%	37%	69%	40%	75%
6. Motor Speech	58%	87%	51%	81%	42%	77%	50%	81%
7. Communication	48%	83%	26%	64%	21%	59%	31%	68%
8. Attention	38%	77%	23%	68%	21%	65%	27%	70%
9. Memory	40%	77%	32%	70%	20%	62%	30%	69%
10. Fund of information	35%	76%	30%	70%	32%	66%	32%	70%
11. Novel problem-solving	34%	76%	33%	68%	23%	56%	29%	66%
12. Visuospatial	43%	80%	28%	66%	33%	66%	35%	70%
13. Anxiety	38%	82%	40%	82%	38%	78%	39%	80%
14. Depression	46%	81%	38%	82%	29%	86%	37%	83%
15. Irritability	39%	82%	47%	90%	39%	79%	42%	84%
16. Pain/headache	53%	88%	54%	92%	44%	79%	50%	86%
17. Fatigue	36%	76%	32%	76%	31%	79%	33%	77%
18. Mild symptoms	44%	76%	28%	67%	36%	67%	35%	69%
19. Inappropriate social interaction	43%	76%	31%	67%	34%	66%	36%	69%
20. Impaired self-awareness	35%	60%	32%	68%	18%	46%	28%	58%
21. Family	40%	78%	34%	79%	24%	63%	32%	73%
22. Initiation	24%	70%	39%	66%	37%	68%	34%	68%
23. Social Contact	43%	73%	43%	71%	22%	56%	35%	66%
24. Leisure	28%	69%	40%	74%	31%	67%	33%	70%
25. Self-care	55%	85%	56%	90%	53%	85%	54%	86%
26. Residence	40%	74%	42%	82%	31%	57%	37%	71%
27. Transportation	47%	84%	60%	82%	39%	76%	48%	81%
28. Employment	79%	89%	71%	83%	60%	76%	69%	82%
29. Money management	31%	73%	39%	73%	31%	58%	34%	68%

Validity

Concurrent and predictive validity of the Staff MPAI has been demonstrated in a number of studies. The Staff MPAI correlates moderately well with the Disability Rating Scale, Rancho scale, neuropsychological measures, and the SO MPAI.[6, 17] Because successive versions of the MPAI measure the same underlying construct with increasing consistency and sensitivity, validity studies of earlier versions support the validity of later versions.

Rasch analysis provides a means for converting scores from the MPAI to an interval-equivalent scale that can then be used in parametric statistical analyses. Using this interval-equivalent MPAI scale, other studies have looked at the predictive validity of the MPAI. In one study,[13] logistic regression

demonstrated that the original Staff MPAI ($\chi^2 = 8.30$, $p < .01$) and time since injury ($\chi^2 = 9.70$, $p < .01$) were the best predictors (69% correct classification for full model) of job placement following participation in a vocational rehabilitation program designed specifically for people with ABI. Other potential predictors included in the model that did not contribute to this prediction were age, education, severity of injury, traumatic vs. nontraumatic injury, and a self-awareness measure (the difference between Staff MPAI and Self MPAI).

In another study,[18] the original Staff MPAI was the best predictor of long term vocational and independent living outcome following a comprehensive day rehabilitation program for people with ABI. Logistic regression analysis included age, education, severity of injury, traumatic vs. nontraumatic injury, time since injury, and Rasch-converted Staff MPAI score as potential predictors. This analysis showed that the MPAI alone predicted vocational status one-year after program participation (correct classification = 67%; $\chi^2 = 5.33$, $p < .05$). Logistic regression analysis of this same set of predictor variables also found the MPAI was the only significant predictor of independent living status one year after program completion (correct classification = 70%; $\chi^2 = 6.85$, $p < .01$). Those with scores below the 60th percentile (compared to other outpatients with ABI) had a very good chance (86%) of living independently with no supervision one year after program completion. In contrast, those at greater levels of disability (that is, at or above the 60th percentile on the MPAI) had only approximately a 50/50 chance of progressing to completely independent living. Only 30% of program completers with scores below the 70th percentile on the MPAI prior to admission to the program were unemployed one year after program completion. In contrast, 73% of those with scores at or above the 70th percentile were unemployed at one -year follow-up. Identification of individuals who are at high risk for failure in state-of-the-art rehabilitation programs, such as the one evaluated in this study, is important for planning future rehabilitation services. Clearly such individuals will typically require interventions that go beyond traditional day treatment, potentially involving more extensive community-based services and the development of long-term supports.

Malec and Degiorgio[19] reported that logistic regression of the MPAI and time since injury could be used to estimate the probability of community-based employment as a result of either comprehensive day treatment or limited outpatient rehabilitation and vocational intervention following ABI. For instance, people with ABI evaluated more than two years post-injury were often able to return to community-based employment with only limited vocational and outpatient rehabilitation services despite demonstrating a greater than average level of disability on the MPAI. However, those seen more than five or ten years after trauma with greater than average disability on the MPAI showed a low probability of vocational success with limited intervention. Similar individuals (above average disability per MPAI; many years post-injury) were found to have a substantially higher probability of success with intensive day treatment.

Rationally-derived MPAI-4 subscales. Subscales emerged from principal components analyses of residual item scores following Rasch analysis of previous versions of the MPAI. These principal components analyses informed the selection of items for subscales. However, items for the MPAI-4 subscales or *indices* ultimately were selected on a "rational" basis, that is, because they corresponded to clinical experience and appeared of value in clinical settings as well as cohered on a statistical basis. Rational subscales for items are described in Table 10. For the national sample of 386, Rasch analyses of each of these three subscales separately showed a reduction in Person and Item Separation and Reliability for each; however, the Reliability and Separation of each subscale remained adequate (see Table 4). For the Mayo sample, Reliability and Separation varied with rater group (i.e., people with AB I, SO, staff) for each subscale (see Tables 5-8). Most of these indicators were within acceptable limits. Rasch Facets

Analysis of measures that combined ratings for all three rater groups resulted in Reliability and Separation indicators that were good to excellent (Tables 5-8).

Item cluster analysis. Hierarchical cluster analysis of items with the Ward-Hook Method produced a result similar to rational item groupings. The 3-cluster solution grouped items into clusters that overlapped considerably with rational groups. A comparison of item-subscale correlations for items assigned to different groups, based on rational versus empirical clustering, indicated there was no statistical advantage to moving the item to a different group (see Tables 10 and 11).

Table 10: Content and Internal Consistency of Rational MPAI-4 Subscales

Abilities	Adjustment	Participation
Mobility **Use of hands** **Motor speech** **Communication** **Fund of information** **Visuospatial abilities** Dizziness/balance (.41) Vision (.37)* Audition (.17) Attention/concentration (.48) Memory (.55) Novel problem solving (.55)	**Anxiety** **Depression** **Irritability, anger, Aggression** **Pain and headache** **Fatigue** **Sensitivity to mild Symptoms** **Inappropriate social Interaction** **Initiation** **Social contact** **Leisure/recreation activities** Impaired self awareness (.44) Family/significant Relationships (.41)	**Initiation** **Social contact** **Leisure/recreation activities** **Residence** **Transportation** **Work/school** **Money management** Self-care (.61)
R_{xx}, (alpha) = .80	r_{xx}, (alpha) = .76	r_{xx}, (alpha) = .83

Items assigned by empirical clustering to a different subscale from that assigned on a rational basis did not correlate markedly better with the subscale assigned empirically than with the subscale assigned rationally. For instance, empirical clustering assigned Self-care to the Ability Index and rational clustering assigned this same item to the Participation Index. The item itself showed a slightly higher correlation with the Participation Index (.61; see Table 10) than with the Ability Index (.57; see Table11). Differences in item placement from one set of subscales to another are interesting in their own right, however, because they illustrate the interdependency between capacity and function.

Table 11: Content and Internal Consistency of Empirical MPAI-4 Subscales Derived from Cluster Analysis (Ward-Hook Method)/		
Abilities	**Adjustment**	**Participation**
Mobility	**Anxiety**	**Initiation**
Use of hands	**Depression**	**Social contact**
Motor speech	**Irritability, anger, Aggression**	**Leisure/recreation activities**
Communication		**Residence**
Fund of information	**Pain and headache**	**Transportation**
Visuospatial abilities	**Fatigue**	**Work/school**
Self-care (.57)*	**Sensitivity to mild Symptoms**	**Money management**
		Attention/concentration (.50)
	Inappropriate social Interaction	Memory (.54)
		Novel problem solving (.63)
	Vision (.23)	Impaired self awareness (.54)
	Audition (.25)	Family/significant relationships (.36)
	Dizziness/balance (.53)	
R_{XX}, (alpha) = .78	r_{XX}, (alpha) = .73	r_{XX}, (alpha) = .85

* For Tables 10 and 11, item-subscale correlations in parenthesis are for items assigned differently with empirical vs. rational assignment; items common to both sets of subscales are highlighted.

Principal Components Analysis. Principal components analysis with varimax rotation of the 29-item MPAI-3 yielded seven factors with eigenvalues of at least 1.0 (see Table 12). Results of this analysis are consistent with a previous study.[17] For understanding the multifactorial structure of outcome following ABI, factor analysis may be informative. However, the rather strong internal consistency of the three rational subscales suggests that for practical use, further item subdivisions are not only unnecessary but produce scales consisting of small numbers of items that are consequently of limited reliability and utility.

As a result of these analyses, we concluded that empirically derived subscales were not superior to rationally derived subscales. The rationally derived subcales possessed satisfactory internal consistency by Rasch measures as well as by the more traditional psychometric *alpha* coefficient. The viability of rationally derived subscales is supported by item cluster analysis. Item cluster analysis did not precisely reflect rational subscale assignment. However, items did not correlate markedly better (and in many cases correlated slightly less well) with the subscale to which they were assigned on an empirical basis than they did to the subscale assigned on a rational basis. We retained rational assignment because it reflects more general clinical theory and practice.

That in many cases individual items correlate about as well with one subscale or another reflects the strong unitary dimension underlying these subscales. Correlations among subscales suggest that each subscale accounts for a degree of independent variance. However, correlations between subscales are moderate and taken together with the Rasch analysis suggest that each of these subcales represents a different region of a unitary underlying dimension.

Table 12: Rotated factor structure of the MPAI-4			
I	**II**	**III**	**IV**
Memory Novel problem-solving Fund of information. Attention/ concentration Initiation Communication Self-awareness	Transportation Residence Work/school Self-cares Money management	Family/significant Relationships Social contact Leisure/recreation Inappropriate social Interaction	Motor speech Use of hands Mobility
V	**VI**	**VII**	
Sensitivity to mild Symptoms Anxiety Irritability, anger Aggression Depression	Pain, headache Fatigue Dizziness/ Balance	Vision Audition Visuospatial Abilities	

Additional psychometric properties of subscales. Traditional psychometric indicators of internal consistency (i.e., *alpha* coefficients) for rational item subscales are acceptable for rating scales, ranging from .76 to .83 (average .79). Inter-scale correlations are lower, indicating a degree of independence among scales, as shown in Table 13.

Table 13: Interscale correlations of recoded MPAI-4 subscales.			
Subscale:	**Ability**	**Adjustment**	**Participation**
Adjustment	.49		
Participation	.65	.63	
Full Scale	.86	.82	.84

Comparability of data obtained people with ABI, SO, and staff. We have investigated the contrast between self-rating by persons with ABI on the MPAI and the ratings of these same people by rehabilitation staff.[20] Differences between Staff MPAI ratings compared to Self MPAI ratings appear due to multiple factors including: different interpretations of terminology by lay people and professionals; differing values; differing observational opportunities; the differing impact/burden of sequelae on people with ABI, SO, and staff; depression; and self-awareness among people with ABI. Differences between Staff MPAI and Self MPAI did not predict vocational outcome of a vocational rehabilitation program[13] or outcome of comprehensive day rehabilitation.[18] These findings suggest that people with ABI can be engaged in effective services with rehabilitation providers despite initial disagreements between them and staff about the nature and extent of impairments and disabilities.

Results of a subsequent study[16] revealed satisfactory internal consistency and inter-rater agreement for the MPAI-4, regardless of rating source (see Tables 5-9). Nonetheless, detailed inspection of data obtained again revealed a number of sources of potential rater bias, including lack of self-awareness, bias towards positive self-evaluation, and aspirational bias on the part of the person with ABI; advocacy and sensitivity to impact and burden of the difficulties of the person with ABI on the part of SO; and enhanced objectivity as well as more limited sensitivity to and experience with the person with ABI on the part of staff.

From a pure measurement perspective, rater bias and its negative impact on reliability is undesirable. However, in the clinical settings in which the MPAI-4 is used, these types of rater biases may accurately represent the differing perspectives of people with ABI, their SO, and staff. Assessment of these varying perspectives and biases in the clinical setting is not only representational of *outcome* as evaluated by the different parties involved, but is often essential to developing effective plans for rehabilitation and other interventions. Effective interventions cannot be implemented if there is substantial disagreement about the nature of the problem to be addressed. Discussions as well as other types of interactions and experiential explorations may need to occur among involved parties to resolve important areas of disagreement discovered through MPAI-4 assessment before all parties will actively commit to and participate in intervention plans.

Review of individual cases in this sample reveals examples of all possible variations of agreement and disagreement (that is, staff agreeing on items with people with ABI but not with the SO; SO agreeing with staff but not with the person with ABI; SO and the person with ABI agreeing with each other but not with staff). Exploration of specific variations and biases in the individual case is possible with independent completion of the MPAI-4 by the person with ABI, SO, and staff and may be beneficial, if not be critical, to future treatment planning.

The MPAI Participation Index (M2PI)

Because a measure of outcome after ABI that focuses on social participation with acceptable psychometric properties is lacking in the field, we conducted more specific evaluation of the Participation Index of the MPAI-4.[21] As can be seen in Table 13, previous evaluation of the MPAI completed by rehabilitation staff for 386 adults with ABI showed a relatively strong correlation between the 8-item Participation subscale and the total score for the 29-item MPAI. We further explored the viability of the MPAI Participation Index as an independent measure of outcome after ABI as completed not only by staff, but also by people with ABI and their SO in the sample of 134 persons with ABI seen at Mayo. The MPAI was completed by staff in all 134 cases, independently for 103 of these persons by an SO, and independently by 115 of the people with ABI themselves. The Participation Index rates initiation, social contact, leisure, self-care, residence, transportation, employment, and money management (see Table 1).

Rasch Facets analysis revealed strong internal consistency for a composite form of the 8-item Participation Index that combined ratings of staff, persons with ABI, and SO (Table14). This composite index correlated moderately well with a composite measure based on all 29 MPAI items (Pearson r = .77; Table 15). Using the 3-rater composite Participation Index as the "gold standard," measures based on pairs and individual classes of raters were evaluated. Reliability and Separation indicators for measures based on the M2PI completed by various rater groups and combinations of these groups are provided in

Table 14. Pearson correlations of M2PI measures with the 3-rater Full Scale composite index (and with each other) are shown in the Table 15.

Table 14: Rasch indicators for M2PI completed by each of 3 rater groups and composite indices.

Participation Index completed by:	Person Reliability (Separation)	Item Reliability (Separation)
People with ABI, SO, staff (3-rater composite)	.89 (2.80)	.99 (9.80)
People with ABI and staff (2-rater composite)	.85 (2.43)	.99 (8.69)
People with ABI and SO (2-rater composite)	.84 (2.33)	.98 (7.26)
Staff and SO (2-rater composite)	.89 (2.78)	.99 (8.96)
People with ABI	.74 (1.70)	.97 (5.70)
SO	.82 (2.15)	.97 (5.50)
Staff	.85 (2.41)	.99 (8.17)

As can be seen in Figures 1 and 2, cumulative distributions for M2PI raw scores show minimal floor or ceiling effects unlike other brief scales of ABI outcome.[1, 2] (Raw scores for the 3-rater composite measure were placed on the same scale as independent ratings by dividing the total score by 3; all scores were prorated for missing data.) As can be seen in Figure 1, the cumulative distribution of raw scores for the 3-rater M2PI composite index approximates an "S-curve" that is characteristics of normal distributions. The curve for M2PI raw scores for ratings made by people with ABI climbs more rapidly than the 3-rater curve and reaches the median value (50th percentile) between scores of 10 and 11, illustrating the tendency of the group toward lower self-ratings. Despite this tendency, very low scores (<3) are infrequent (9%) among these self-ratings. The distribution for staff raw scores climbs less rapidly and finds the median value at about 16, illustrating the tendency of this rater group toward higher ratings. The lower third of the distribution for SO tracks closely to the distribution of people with ABI then crosses over to track more closely with the distribution for staff. Both of staff and SO have a low percentage (<7%) of very low scores (<3) and very high scores (>27) are rare for all groups (< 5%).

Table 15: Pearson correlations among measures for MPAI Full Scale and M2PI composite and independent ratings

M2PI completed by:	Full Scale (29-item) 3-Rater Composite Index	M2PI completed by: People with ABI, SO, staff	People with ABI and staff	People with ABI and SO	SO and staff	People with ABI	SO
People with ABI, SO, staff (3-rater composite)	.77						
People with ABI and staff (2-rater composite)	.81	.97					
People with ABI and SO (2-rater composite)	.86	.93	.88				
Staff and SO (2-rater composite)	.72	.95	.88	.83			
People with ABI	.80	.78	.81	.87	.60		
SO	.72	.88	.77	.88	.92	.62	
Staff	.61	.89	.88	.70	.93	.50	.74

Figure 2 displays distributions for composite measures derived from pairs of ratings compared to the 3-rater composite. (To place Figure 2 on the same metric as Figure 1, total scores for paired ratings were divided in half.) The measure combining ratings made by staff with those made by people with ABI closely approximates the distribution of scores for the 3-rater composite M2PI measure.

The brief 8-item M2PI demonstrates relatively strong internal consistency and concurrent validity as demonstrated by moderately strong correlation with the Full Scale MPAI. Ratings made by rehabilitation staff combined with those made by the person with ABI provide a good approximation of composite ratings made by all three classes of raters. Potentially the M2PI may be completed for research or rehabilitation outcome evaluation through minimal personal or telephone contact.

Figure 1: Cumulative distributions of M2PI total raw scores by rater group and 3-rater composite index

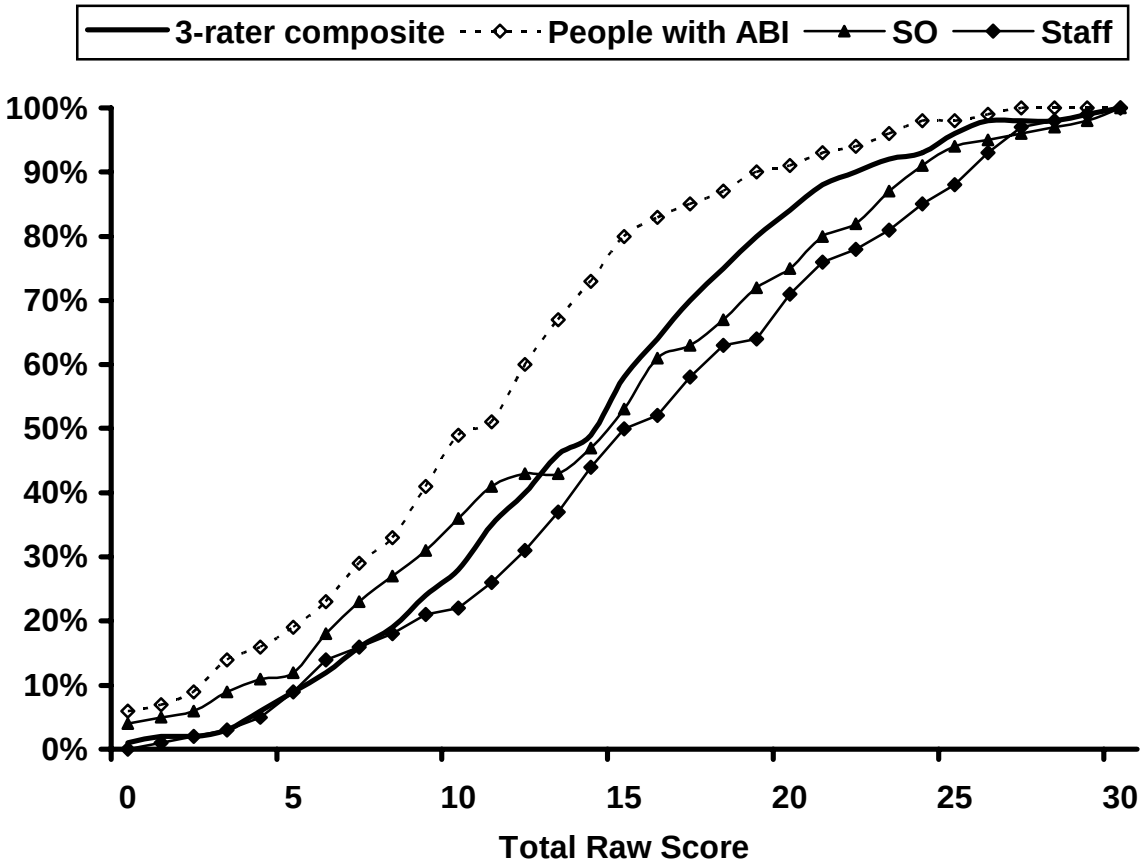
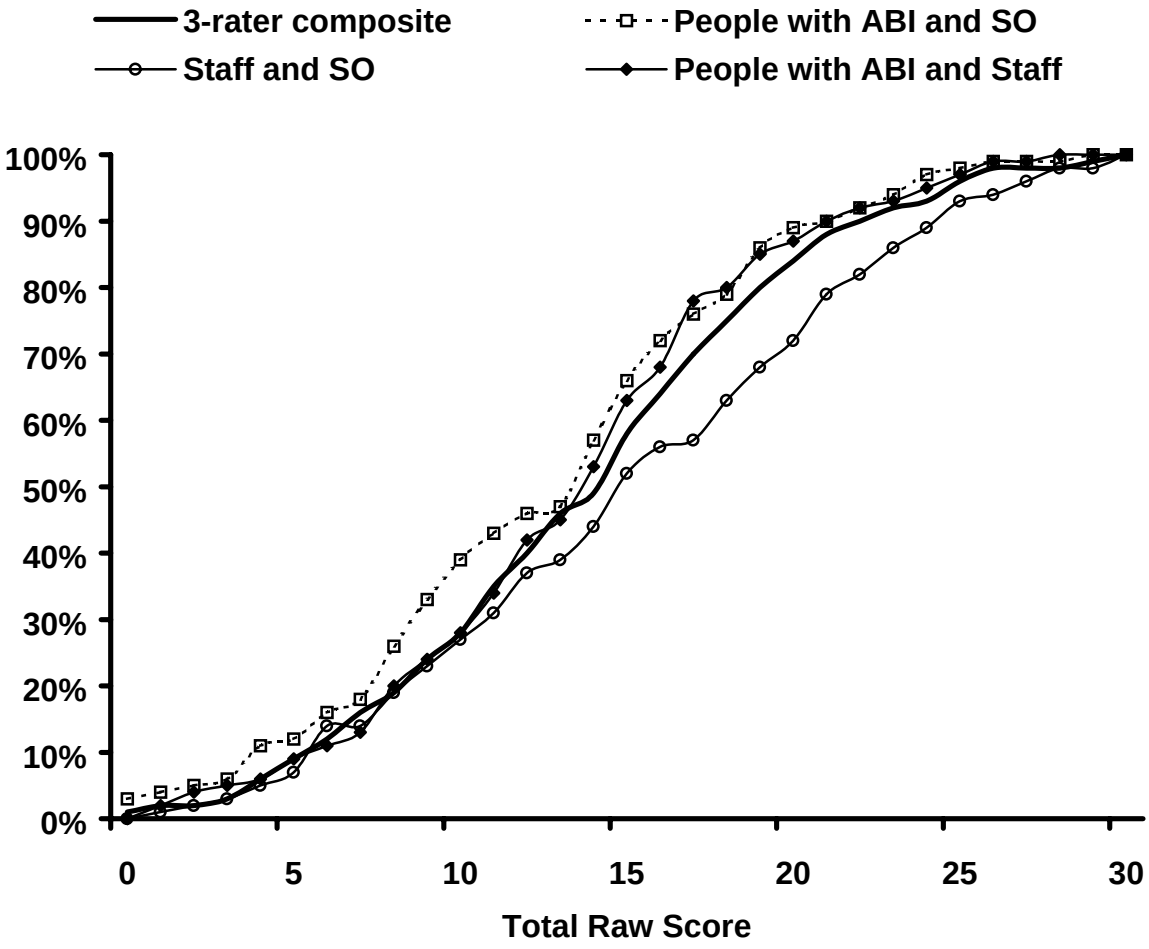


Figure 2: Cumulative distributions of total raw scores for 3- and 2-rater composite indices



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APPENDICES

Raw Score to T Score Conversion Tables

Raw scores from the Total Score and three Indices of the MPAI-4 may be converted to standardized T scores (Mean = 50; SD = 10) by using Tables in Appendices 1-IV. T-score conversion is recommended because it facilitates comparisons between subscale scores and identification of specific areas for intervention, i.e., ability, activity, and participation.

T-scores in Appendix I are based on a reference sample of 386 individuals with ABI receiving outpatient, community-based or residential rehabilitation. Demographic features of the sample are described in Table 2. Ratings for this sample were made by professional staff. All of these individuals have a history of ABI which was moderate to severe in the vast majority of cases. Consequently T-score conversion does not provide normative data in the classic sense of comparison to a "normal" (i.e., uninjured) reference group. T-score conversion for the MPAI-4 does provide comparison to a group of people with moderate to severe injury.

T-scores in Appendix II –IV are based on a reference sample of people seen only at Mayo-Rochester for outpatient brain injury rehabilitation evaluations. Demographic features of this sample are described in Table 3. Appendix II provides raw to T-score conversion data for ratings made by staff; Appendix III provides for conversion of ratings made by people with ABI; and Appendix IV for conversion of ratings made by SO.

T scores between 40 and 60 would be considered average or typical of people involved in outpatient, community-based, or residential rehabilitation following brain injury. T-scores between 40 and 50 may be considered in the mild to moderate range of overall severity compared to other people with ABI.; T-scores between 50 and 60, in the moderate to severe range.

T-scores above 60 would suggest severe limitations even as compared to other people with ABI.

T-scores between 30 and 40 suggest mild limitations.

T-scores below 30 represent relatively good outcomes.

APPENDIX I: NATIONAL SAMPLE STAFF RATINGS

Table I-A: Conversion of raw scores to T scores (Mean = 50; SD = 10) for Staff MPAI-4 Total Score (National sample)

Raw Score	**T Score**	Raw Score	**T Score**	Raw Score	**T Score**
0	**-38**	38	**43**	76	**62**
1	**-16**	39	**44**	77	**63**
2	**-4**	40	**44**	78	**63**
3	**2**	41	**45**	79	**64**
4	**7**	42	**45**	80	**65**
5	**11**	43	**46**	81	**65**
6	**13**	44	**46**	82	**66**
7	**16**	45	**47**	83	**67**
8	**18**	46	**47**	84	**67**
9	**20**	47	**47**	85	**68**
10	**21**	48	**48**	86	**69**
11	**23**	49	**48**	87	**69**
12	**24**	50	**49**	88	**70**
13	**25**	51	**49**	89	**71**
14	**26**	52	**50**	90	**72**
15	**27**	53	**50**	91	**73**
16	**28**	54	**51**	92	**74**
17	**29**	55	**51**	93	**75**
18	**30**	56	**52**	94	**76**
19	**31**	57	**52**	95	**77**
20	**32**	58	**53**	96	**78**
21	**33**	59	**53**	97	**79**
22	**33**	60	**54**	98	**80**
23	**34**	61	**54**	99	**81**
24	**35**	62	**55**	100	**82**
25	**35**	63	**55**	101	**84**
26	**36**	64	**56**	102	**85**
27	**37**	65	**56**	103	**87**
28	**37**	66	**57**	104	**88**
29	**38**	67	**57**	105	**90**
30	**39**	68	**58**	106	**92**
31	**39**	69	**58**	107	**94**
32	**40**	70	**59**	108	**97**
33	**40**	71	**59**	109	**99**
34	**41**	72	**60**	110	**102**
35	**41**	73	**60**	111	**106**
36	**42**	74	**61**		
37	**42**	75	**62**		

APPENDIX I: NATIONAL SAMPLE STAFF RATINGS

Table I-B: Conversion of raw scores to T scores (Mean = 50; SD = 10) for Staff MPAI-4 Ability Subscale (National sample

Raw Score	**T Score**	Raw Score	**T Score**	Raw Score	**T Score**
0	**-4**	17	**48**	34	**66**
1	**12**	18	**49**	35	**68**
2	**21**	19	**50**	36	**69**
3	**25**	20	**51**	37	**71**
4	**29**	21	**52**	38	**73**
5	**31**	22	**53**	39	**74**
6	**34**	23	**54**	40	**77**
7	**35**	24	**55**	41	**79**
8	**37**	25	**56**	42	**81**
9	**39**	26	**57**	43	**84**
10	**40**	27	**58**	44	**88**
11	**41**	28	**59**	45	**92**
12	**42**	29	**60**	46	**99**
13	**44**	30	**61**	47	**109**
14	**45**	31	**62**		
15	**46**	32	**63**		
16	**47**	33	**65**		

Table I-C: Conversion of raw scores to T scores (Mean = 50; SD = 10) for Staff MPAI-4 Adjustment Subscale (National sample)

Raw Score	**T Score**	Raw Score	**T Score**	Raw Score	**T Score**
0	**-6**	16	**46**	32	**62**
1	**10**	17	**47**	33	**63**
2	**19**	18	**48**	34	**64**
3	**24**	19	**49**	35	**65**
4	**28**	20	**50**	36	**67**
5	**30**	21	**51**	37	**68**
6	**33**	22	**52**	38	**70**
7	**35**	23	**53**	39	**71**
8	**36**	24	**54**	40	**73**
9	**38**	25	**55**	41	**75**
10	**39**	26	**55**	42	**78**
11	**41**	27	**56**	43	**80**
12	**42**	28	**57**	44	**84**
13	**43**	29	**58**	45	**88**
14	**44**	30	**59**	46	**94**
15	**45**	31	**60**		

APPENDIX I: NATIONAL SAMPLE STAFF RATINGS

Table I-D: Conversion of raw scores to T scores (Mean = 50; SD = 10) for Staff MPAI-4 Participation Subscale (National sample)

Raw Scores	**T Scores**	Raw Scores	**T Scores**	Raw Scores	**T Scores**
0	**7**	11	**40**	22	**52**
1	**19**	12	**41**	23	**53**
2	**25**	13	**42**	24	**55**
3	**28**	14	**43**	25	**57**
4	**31**	15	**44**	26	**59**
5	**33**	16	**45**	27	**62**
6	**34**	17	**46**	28	**65**
7	**36**	18	**47**	29	**69**
8	**37**	19	**48**	30	**74**
9	**38**	20	**49**		
10	**39**	21	**50**		

APPENDIX II: MAYO SAMPLE STAFF RATINGS

Table II-A: Conversion of raw scores to T scores (Mean = 50; SD = 10) for Staff MPAI-4 Total Score (Mayo sample)

Raw Score	T Score	Raw Score	T Score	Raw Score	T Score
0	**-42**	38	**46**	76	**70**
1	**-19**	39	**46**	77	**71**
2	**-7**	40	**47**	78	**72**
3	**0**	41	**48**	79	**73**
4	**5**	42	**48**	80	**74**
5	**9**	43	**49**	81	**74**
6	**12**	44	**49**	82	**75**
7	**14**	45	**50**	83	**76**
8	**16**	46	**51**	84	**77**
9	**18**	47	**51**	85	**78**
10	**20**	48	**52**	86	**79**
11	**21**	49	**53**	87	**80**
12	**23**	50	**50**	88	**81**
13	**24**	51	**54**	89	**82**
14	**25**	52	**55**	90	**83**
15	**27**	53	**55**	91	**84**
16	**28**	54	**56**	92	**85**
17	**29**	55	**56**	93	**86**
18	**30**	56	**57**	94	**87**
19	**31**	57	**58**	95	**89**
20	**32**	58	**58**	96	**90**
21	**33**	59	**59**	97	**91**
22	**34**	60	**60**	98	**93**
23	**34**	61	**60**	99	**94**
24	**35**	62	**61**	100	**96**
25	**36**	63	**61**	101	**97**
26	**37**	64	**62**	102	**99**
27	**38**	65	**63**	103	**101**
28	**38**	66	**63**	104	**103**
29	**39**	67	**64**	105	**105**
30	**40**	68	**65**	106	**107**
31	**41**	69	**65**	107	**110**
32	**41**	70	**66**	108	**113**
33	**42**	71	**67**	109	**116**
34	**43**	72	**68**	110	**119**
35	**44**	73	**68**	111	**123**
36	**44**	74	**69**		
37	**45**	75	**70**		

APPENDIX II: MAYO SAMPLE STAFF RATINGS

Table II-B: Conversion of raw scores to T scores (Mean = 50; SD = 10) for Staff MPAI-4 Ability Subscale (Mayo sample)

Raw Score	T Score	Raw Score	T Score	Raw Score	T Score
0	**1**	17	**52**	34	**75**
1	**15**	18	**54**	35	**77**
2	**22**	19	**55**	36	**79**
3	**27**	20	**56**	37	**80**
4	**30**	21	**57**	38	**81**
5	**33**	22	**58**	39	**85**
6	**35**	23	**60**	40	**87**
7	**37**	24	**61**	41	**90**
8	**39**	25	**62**	42	**93**
9	**41**	26	**63**	43	**96**
10	**42**	27	**65**	44	**100**
11	**44**	28	**66**	45	**105**
12	**46**	29	**67**	46	**111**
13	**47**	30	**69**	47	**121**
14	**48**	31	**70**		
15	**50**	32	**72**		
16	**51**	33	**73**		

Table II-C: Conversion of raw scores to T scores (Mean = 50; SD = 10) for Staff MPAI-4 Adjustment Subscale (Mayo sample)

Raw Score	T Score	Raw Score	T Score	Raw Score	T Score
0	**-14**	16	**45**	32	**65**
1	**4**	17	**46**	33	**67**
2	**13**	18	**47**	34	**69**
3	**18**	19	**49**	35	**70**
4	**22**	20	**50**	36	**72**
5	**25**	21	**51**	37	**74**
6	**28**	22	**52**	38	**76**
7	**30**	23	**53**	39	**78**
8	**32**	24	**55**	40	**81**
9	**34**	25	**56**	41	**84**
10	**36**	26	**57**	42	**87**
11	**38**	27	**59**	43	**90**
12	**39**	28	**60**	44	**94**
13	**41**	29	**61**	45	**100**
14	**42**	30	**63**	46	**107**
15	**43**	31	**64**		

APPENDIX II: MAYO SAMPLE STAFF RATINGS

Table II-D: Conversion of raw scores to T scores (Mean = 50; SD = 10) for Staff MPAI-4 Participation Subscale (Mayo Sample)

Raw Scores	**T Scores**	Raw Scores	**T Scores**	Raw Scores	**T Scores**
0	**15**	11	**44**	22	**57**
1	**24**	12	**45**	23	**59**
2	**29**	13	**46**	24	**60**
3	**32**	14	**47**	25	**62**
4	**34**	15	**48**	26	**64**
5	**36**	16	**49**	27	**67**
6	**38**	17	**51**	28	**69**
7	**39**	18	**52**	29	**73**
8	**40**	19	**53**	30	**78**
9	**41**	20	**54**		
10	**42**	21	**56**		

APPENDIX III: MAYO SAMPLE RATINGS BY PEOPLE WITH ABI

Table III-A: Conversion of raw scores to T scores (Mean = 50; SD = 10) for Self MPAI-4 Total Score (Mayo sample)

Raw Score	T Score	Raw Score	T Score	Raw Score	T Score
0	**-4**	38	**51**	76	**63**
1	**10**	39	**51**	77	**63**
2	**18**	40	**51**	78	**63**
3	**23**	41	**52**	79	**64**
4	**26**	42	**52**	80	**64**
5	**28**	43	**52**	81	**65**
6	**30**	44	**53**	82	**65**
7	**32**	45	**53**	83	**65**
8	**33**	46	**53**	84	**66**
9	**35**	47	**53**	85	**66**
10	**36**	48	**54**	86	**67**
11	**37**	49	**54**	87	**67**
12	**38**	50	**54**	88	**68**
13	**39**	51	**55**	89	**68**
14	**39**	52	**55**	90	**69**
15	**40**	53	**55**	91	**69**
16	**41**	54	**56**	92	**70**
17	**41**	55	**56**	93	**70**
18	**42**	56	**56**	94	**71**
19	**43**	57	**57**	95	**71**
20	**43**	58	**57**	96	**72**
21	**44**	59	**57**	97	**72**
22	**44**	60	**57**	98	**73**
23	**45**	61	**58**	99	**74**
24	**45**	62	**58**	100	**75**
25	**46**	63	**58**	101	**75**
26	**46**	64	**59**	102	**76**
27	**46**	65	**59**	103	**77**
28	**47**	66	**59**	104	**78**
29	**47**	67	**60**	105	**79**
30	**48**	68	**60**	106	**80**
31	**48**	69	**60**	107	**81**
32	**48**	70	**61**	108	**81**
33	**49**	71	**61**	109	**84**
34	**49**	72	**61**	110	**86**
35	**50**	73	**62**	111	**88**
36	**50**	74	**62**		
37	**50**	75	**62**		

APPENDIX III: MAYO SAMPLE RATINGS BY PEOPLE WITH ABI

Table III-B: Conversion of raw scores to T scores (Mean = 50; SD = 10) for Self MPAI-4 Ability Subscale (Mayo sample)

Raw Score	**T Score**	Raw Score	**T Score**	Raw Score	**T Score**
0	**7**	17	**51**	34	**65**
1	**20**	18	**52**	35	**66**
2	**27**	19	**53**	36	**67**
3	**32**	20	**53**	37	**68**
4	**35**	21	**54**	38	**69**
5	**37**	22	**55**	39	**70**
6	**39**	23	**56**	40	**72**
7	**41**	24	**56**	41	**74**
8	**42**	25	**57**	42	**75**
9	**43**	26	**58**	43	**78**
10	**45**	27	**59**	44	**80**
11	**46**	28	**59**	45	**83**
12	**47**	29	**60**	46	**88**
13	**48**	30	**61**	47	**96**
14	**49**	31	**62**		
15	**49**	32	**63**		
16	**50**	33	**64**		

Table III-C: Conversion of raw scores to T scores (Mean = 50; SD = 10) for Self MPAI-4 Adjustment Subscale (Mayo sample)

Raw Score	**T Score**	Raw Score	**T Score**	Raw Score	**T Score**
0	**12**	16	**49**	32	**61**
1	**23**	17	**50**	33	**62**
2	**29**	18	**51**	34	**63**
3	**33**	19	**52**	35	**64**
4	**35**	20	**53**	36	**65**
5	**37**	21	**53**	37	**66**
6	**39**	22	**54**	38	**67**
7	**41**	23	**55**	39	**68**
8	**42**	24	**55**	40	**69**
9	**43**	25	**56**	41	**70**
10	**44**	26	**57**	42	**72**
11	**45**	27	**58**	43	**73**
12	**46**	28	**58**	44	**75**
13	**47**	29	**59**	45	**78**
14	**48**	30	**60**	46	**81**
15	**49**	31	**60**		

APPENDIX III: MAYO SAMPLE RATINGS BY PEOPLE WITH ABI

Table III-D: Conversion of raw scores to T scores (Mean = 50; SD = 10) for Self MPAI-4 Participation Subscale (Mayo sample)

Raw Scores	**T Scores**	Raw Scores	**T Scores**	Raw Scores	**T Scores**
0	**4**	11	**49**	22	**66**
1	**20**	12	**51**	23	**68**
2	**28**	13	**52**	24	**70**
3	**33**	14	**54**	25	**72**
4	**36**	15	**55**	26	**74**
5	**39**	16	**56**	27	**77**
6	**41**	17	**58**	28	**81**
7	**43**	18	**59**	29	**85**
8	**45**	19	**61**	30	**91**
9	**46**	20	**62**		
10	**48**	21	**64**		

APPENDIX IV: MAYO SAMPLE SO RATINGS

Table I-A: Conversion of raw scores to T scores (Mean = 50; SD = 10) for SO MPAI-4 Total Score (Mayo sample)

Raw Score	**T Score**	Raw Score	**T Score**	Raw Score	**T Score**
0	**-9**	38	**48**	76	**61**
1	**-5**	39	**49**	77	**61**
2	**14**	40	**49**	78	**62**
3	**19**	41	**49**	79	**62**
4	**22**	42	**50**	80	**63**
5	**25**	43	**50**	81	**63**
6	**27**	44	**50**	82	**63**
7	**29**	45	**51**	83	**64**
8	**30**	46	**51**	84	**64**
9	**32**	47	**51**	85	**65**
10	**33**	48	**52**	86	**65**
11	**34**	49	**52**	87	**66**
12	**35**	50	**52**	88	**66**
13	**36**	51	**53**	89	**67**
14	**37**	52	**53**	90	**67**
15	**37**	53	**53**	91	**68**
16	**38**	54	**54**	92	**68**
17	**39**	55	**54**	93	**69**
18	**39**	56	**54**	94	**69**
19	**40**	57	**55**	95	**70**
20	**41**	58	**55**	96	**71**
21	**41**	59	**55**	97	**71**
22	**42**	60	**56**	98	**72**
23	**42**	61	**56**	99	**73**
24	**43**	62	**56**	100	**74**
25	**43**	63	**57**	101	**74**
26	**44**	64	**57**	102	**75**
27	**44**	65	**57**	103	**76**
28	**45**	66	**58**	104	**77**
29	**45**	67	**58**	105	**78**
30	**45**	68	**58**	106	**80**
31	**46**	69	**59**	107	**81**
32	**46**	70	**59**	108	**83**
33	**47**	71	**59**	109	**84**
34	**47**	72	**60**	110	**86**
35	**47**	73	**60**	111	**89**
36	**48**	74	**60**		
37	**48**	75	**61**		

APPENDIX IV: MAYO SAMPLE SO RATINGS

Table IV-B: Conversion of raw scores to T scores (Mean = 50; SD = 10) for SO MPAI-4 Ability Subscale (Mayo sample)

Raw Score	**T Score**	Raw Score	**T Score**	Raw Score	**T Score**
0	**4**	17	**50**	34	**65**
1	**18**	18	**51**	35	**66**
2	**25**	19	**52**	36	**67**
3	**30**	20	**53**	37	**68**
4	**33**	21	**54**	38	**70**
5	**36**	22	**54**	39	**71**
6	**38**	23	**55**	40	**73**
7	**39**	24	**56**	41	**74**
8	**41**	25	**57**	42	**76**
9	**42**	26	**57**	43	**79**
10	**43**	27	**58**	44	**82**
11	**45**	28	**59**	45	**85**
12	**46**	29	**60**	46	**90**
13	**47**	30	**61**	47	**98**
14	**48**	31	**62**		
15	**49**	32	**63**		
16	**49**	33	**64**		

Table IV-C: Conversion of raw scores to T scores (Mean = 50; SD = 10) for SO MPAI-4 Adjustment Subscale (Mayo sample)

Raw Score	**T Score**	Raw Score	**T Score**	Raw Score	**T Score**
0	**6**	16	**47**	32	**59**
1	**18**	17	**48**	33	**60**
2	**26**	18	**49**	34	**61**
3	**30**	19	**50**	35	**62**
4	**32**	20	**50**	36	**63**
5	**35**	21	**51**	37	**64**
6	**37**	22	**52**	38	**65**
7	**38**	23	**53**	39	**66**
8	**40**	24	**53**	40	**68**
9	**41**	25	**54**	41	**69**
10	**42**	26	**55**	42	**71**
11	**43**	27	**55**	43	**73**
12	**44**	28	**56**	44	**76**
13	**45**	29	**57**	45	**79**
14	**46**	30	**58**	46	**83**
15	**47**	31	**59**		

APPENDIX IV: MAYO SAMPLE SO RATINGS

Table IV-D: Conversion of raw scores to T scores (Mean = 50; SD = 10) for MPAI-4 Participation Subscale.

Raw Scores	**T Scores**	Raw Scores	**T Scores**	Raw Scores	**T Scores**
0	**10**	11	**46**	22	**58**
1	**22**	12	**47**	23	**60**
2	**29**	13	**48**	24	**61**
3	**34**	14	**49**	25	**63**
4	**35**	15	**50**	26	**65**
5	**38**	16	**51**	27	**67**
6	**39**	17	**52**	28	**69**
7	**41**	18	**53**	29	**73**
8	**42**	19	**54**	30	**77**
9	**43**	20	**56**		
10	**44**	21	**57**		