Chapter 11

HEALTH-RELATED QUALITY OF LIFE / PARTICIPATION ASSESSMENT

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INTRODUCTION

According to the World Health Organization's International Classification of Functioning, participation refers to the extent to which an individual takes part in the life areas or situations of his or her own choosing.[1] Full participation implies that the individual is capable of engaging in activities in a manner expected of a person without restrictions. Physical, occupational, and speech-language clinicians view participation as a fundamental outcome of intervention. One aspect of a participation-level measure is the assessment of health-related quality of life (HRQOL). Existing studies on HRQOL, as it relates to traumatic brain injury (TBI) of all severity levels, focus primarily on functional status and symptom measurement and do not consistently include assessments of other factors, such as depression and environmental factors.[2,3] Participation-level measures of specific problems service members with concussion/mild traumatic brain injury (c/mTBI) may exhibit are found in this toolkit under the appropriate problem area (eg, Headache Disability Index, Neck Disability Index, Patient-Specific Functional Scale, Canadian Occupational Performance Measure, and Dizziness Handicap Inventory, etc).

Many of the disease-specific measures of participation and quality of life are currently more relevant to those with moderate to severe brain injury.[4] Some examples include the following:

- **The Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36)**. This is a generic tool developed for the Medical Outcomes Study[5] whose psychometric properties are extensively evaluated in multiple populations, with some work done to assess its reliability and validity in the TBI population.[6] This short form was constructed to survey health status and was designed for use in clinical practice, research, health policy evaluation, and general population surveys.[5] The standard SF-36 may be used to assess quality of life relative to active duty military personnel when a more specific version is unavailable.
- **The Mayo-Portland Adaptability Inventory–4 (MPAI-4)**.[7] This assessment can be used to evaluate individuals with acquired brain injury in the post-acute period in addition to being used for program evaluation.[8] It has been used in individuals with mild brain injury.[8,9]
- **The Participation Objective, Participation Subjective (POPS)**. This assessment measures household and societal participation. It has typically been used in those with moderate to severe brain injury.[10]
- **The World Health Organization Quality of Life–BREF (WHOQOL-BREF)**. This is a shortened version of the World Health Organization (WHO) 100-question quality-of-life assessment that measures the impact of disease and impairment measure on four broad domains of physical health, psychological health, social relationships, and environment.[11]
- **The American Speech-Language-Hearing Association National Outcomes Measurement System (ASHA NOMS)**. This assessment includes the functional communication measures (FCMs) used by speech-language pathologists to reflect the effects of intervention on acquired cognitive-communication disorders. The FCMs include nine measures specifically relevant to mild TBI. The ASHA NOMS is recognized and accepted by the Centers for Medicare and Medicaid Services and the National Quality Forum as approved quality measures.[12]

Rehabilitation clinicians are encouraged to consider quality-of-life and participation-level measures to monitor individual service members and to evaluate programs designed to serve the active duty and veteran population. Given the absence of an appropriate military-related measure, a global measure of health status, quality of life, and/or participation would be a component of a site-specific program evaluation. Additionally, these types of assessments can provide information on an individual service member's response to intervention.

The process for determining the most appropriate HRQOL instrument is defined by the program's purpose and goals, and the instruments included here should be considered examples and not all inclusive. It is not uncommon for programs to select several instruments for measuring HRQOL in those with combat-acquired c/mTBI due to the associated complexity of patient symptoms. The purpose of this section of the toolkit is to provide the clinician with sufficient information about the instruments to assist in making an informed decision.

THE 36-ITEM HEALTH SURVEY 2.0

Purpose/Description

The SF-36 is a patient self-report questionnaire that measures health status across eight domains.[5] Four scales relate to functional status, three to well-being, and one to overall health. The overall evaluation of health is based on the general health scale. Physical functioning, role-physical, bodily pain, and general health scales contribute to the physical health summary measure. Vitality, social functioning, role-emotional, and mental health contribute to the mental health summary measure.

Recommended Instrument Use

A version of the SF-36 is available to assess health outcomes for veterans.[13,14] In the absence of a version specific to active duty personnel, the standard SF-36 may be used. Given the need to consider their health status over the prior 4 weeks, memory issues in service members with c/mTBI may make it difficult to answer the questions appropriately. There is a 1-week acute version of the SF-36 that requires recall of health status over the preceding 1 week only.

Administration Protocol/Equipment/Time

It takes approximately 15 minutes to complete the SF-36 questionnaire. Scoring is a two-step process. Initially, the patient's responses are recoded to obtain values between 0 and 100 for each item. A higher score indicates a more favorable health state. Then all the items related to each domain are averaged to obtain a domain score. Scoring instructions are available online for the SF-36, version 1, and a computerized format for scoring the SF-36, version 2, can also be found online (www.qualitymetric.com).

The SF-36 version 1, developed by RAND Health Communications (Santa Monica, CA) is available online (www.rand.org/health/surveys_tools/mos/mos_core_36item.html). In 1996, version 2 of the SF-36 was introduced by Quality Metrics (Lincoln, RI; www.qualitymetric.com). According to Quality Metrics, "The RAND-36 is an exact replica of the content of the SF-36. However, because RAND uses different scoring algorithms for two of the 8 scales (bodily pain, general health), their results for those scales are not comparable with the standard SF-36."[15] SF-36 version 2 is most often used with the scaling and wording changes and requires purchase of a user's manual.

Groups Tested With This Measure

This measure has been used on patients with mild TBI and moderate to severe brain injury. The SF-36 can also distinguish between patients with medical conditions and psychiatric disorders, and between the general population and patients with medical conditions such as kneecap replacement, rheumatoid arthritis, and dialysis.[6]

Interpretability

- Norms: not available for patients with brain injury. One study[6] has shown that patients with mild TBI have significantly lower scores on all scales than a comparison group that had no disabilities.
- Minimal detectable change (MDC): In one study of 14 brain-injured patients (Glasgow Coma Scale [GCS] score < 14) 1 year after injury, the smallest detectable difference was calculated for all SF-36 subscales and ranged from 16.24 to 41.74.[16] If the patient's score is less than the MDC value, it is considered indistinguishable from measurement error.
- Responsiveness estimates: In one study of 14 brain-injured patients (GCS < 14) 1 year after injury, standard error of the measurement values ranged from 5.86 to 25.[16] Because this represents such a large percentage of the overall scale, this tool cannot measure small changes and may be insensitive to changes in a population of brain-injured patients with mild injuries. Improvements to version 2 of the SF-36 have improved responsiveness to change and other psychometric properties.[17]

Reliability Estimates

- Internal consistency: Cronbach's alpha ranged from 0.83 to 0.91 for a group of community-dwelling patients (n = 98) that had sustained mTBI at least 1 year earlier and who had a loss of consciousness and/or confusion for less than 1 day.[6]
- Interrater: Intraclass correlation coefficient (ICC) between psychologists was studied in a sample (n = 14) of brain-injured patients at 1 year after injury. The patients were admitted to a neurosurgical service

and had GCS scores below 14. ICC ranged from 0.44 to 0.94, with the mental health subscale being the least reliable between raters.[16]
- Intrarater: not available
- Test-Retest: ICC's from 0.30 to 0.93, depending on subscale and patient population.[18] For SF-36 version 2, the reliability coefficients are typically greater than 0.70.[17]

Validity Estimates

- Content/Face: This measure appears to survey most aspects of health.
- Criterion: Strong correlations (0.50 to 0.63) were found between SF-36 scales pertaining directly to physical functioning (general health, physical functioning, physical role, bodily pain, vitality) and the physical symptoms scale of the Institute for Rehabilitation Research symptom checklist. As expected, emotional role and mental health scores of the SF-36 were more strongly related to psychological factors than to physical factors on this checklist.[6]

  Similarly strong correlations were found between the SF-36 scales and participants' Health Problems List responses (0.60 to 0.75). Robust correlations (0.52 to 0.77) were found between Beck Depression Inventory (second edition) and the SF-36 subscales. The strongest of these correlations (0.77) was between the Beck Depression Inventory and the Mental Health scale of the SF-36.[6]
- Construct: This measure has been tested for its ability to distinguish patients with multiple diagnoses, for sensitivity to change, and for correlation to numerous other disability, pain, depression, and health scales.[18]

Selected References

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MAYO-PORTLAND ADAPTABILITY INVENTORY

Purpose/Description

The MPAI-4 is a 35-item rating scale that measures problems after brain injury. It can be self-rated or rated by a clinician or significant other. It consists of 29 items in 3 subscales (Ability Index, Adjustment Index, Participation Index) intended to reflect the current status of the individual with brain injury. The additional six items not included in the MPAI-4 score are used to identify the presence of other factors that may be contributing to the individual's current status.[8] The original MPAI was designed to assist in clinical evaluation during the post-acute period following acquired brain injury (ABI), and in the evaluation of rehabilitation programs designed to serve individuals with ABI. Individuals with very severe cognitive impairment should not be given the MPAI.

Recommended Instrument Use: Practice Option

The MPAI-4 may be used by individual clinicians or rehabilitation teams for purposes of:

- **Intervention**. The MPAI-4 provides rehabilitation professionals with a brief and reliable means of assessing functioning in each of these three major domains (ability, adjustment, and participation) to help target areas for intervention and assess progress.
- **Community reintegration**. MPAI-4 items assess major obstacles to community reintegration that may result directly from brain injury, as well as problems in the social and physical environment.
- **Reevaluation**. Periodic reevaluation with MPAI-4 during post-acute rehabilitation or other intervention documents progress, efficacy, and appropriateness of the intervention.
- **Research**. Responses to the MPAI-4 by individuals with longstanding ABI and their caregivers and close acquaintances help answer questions about the future of those who are newly injured and their long-term medical, social, and economic needs.[19]

Administration Protocol/Equipment/Time

The MPAI-4 takes 5 to 10 minutes to administer. The MPAI-4 may be completed by people with ABI, their significant others, medical or rehabilitation professionals, and other designated observers who know the individual well. Scoring and interpretation of the MPAI-4 require professional training and experience. A worksheet is provided in the user manual that guides the user through scoring and rescoring items. Items are rated on a 5-point scale from 0 to 4, where 0 represents the most favorable outcome, no problem, or independence, and 4 represents severe problems.

The MPAI-4 consists of a manual and the MPAI-4 forms, which may be downloaded from The Center for Outcome Measurement in Brain Injury website, copied, and used by clinicians without fee or other charge; however, the authors retain copyright to the MPAI-4 and previous versions.

Groups Tested with this Measure

The MPAI-4 has been used in individuals with acquired TBI ranging in severity from mild to severe, as well as in individuals who have suffered neurologic trauma due to strokes and tumors. It has been used by nationally recognized rehabilitation programs for TBI, including Learning Services Corp, Rehab Without Walls, and the Mayo Clinic Acquired Brain Injury Program.[8]

Interpretability

- Norms: Data are available from two samples for comparison purposes. These data sets were both obtained for adults with ABI ranging in severity from mild to moderately severe, as well as for a small sample of individuals with stroke and other neurologic etiologies in post-acute residential, outpatient, or community-based rehabilitation. The data does not represent true "normative" data because there are no references to a non-ABI sample (for norms, see the revised edition of the Mayo-Portland Adaptability Inventory).[9]
- MDC: not available
- Responsiveness: MPAI-4 provides a broader assessment at lower levels of disability than Disability Rating Scale.[20] Change in MPAI-4 score from pre-admission to the end of a comprehensive day-treatment program was significant (paired $t = 8.35$, $P < 0.0001$[21]).

Reliability Estimates

- Internal consistency has been determined by Rasch analysis (Person reliability = 0.88; item reliability = 0.99) and traditional psychometric indicators (Cronbach's alpha = 0.89).[8] For the three subscales, Person reliability ranged from 0.78 to 0.79, item reliability from 0.98 to 0.99, and Cronbach's alpha from 0.76 to 0.83. Subscales correlated moderately (Pearson r = 0.49–0.65) with each other and strongly with the overall scale (Pearson r = 0.82–0.86).[8]
- Interrater reliability: Person reliability for the self-MPAI was 0.84 (Person separation = 2.29 and item reliability was 0.95).[9]
- Item reliability ranged from 0.97 to 0.99.[19]

Person reliability indicates the degree to which items differentiate people. Item reliability indicates the degree to which items are related for different people. Person reliability over 0.80 and item reliability over 0.90 are desirable. Person separation is used to classify people. In Rasch analysis, a separation of at least 2 is desired.[9]

Validity Estimates

- Construct validity: 0.98[22]
- Concurrent validity: original MPAI consensus ratings correlated with Disability Rating Scale scores (r = 0.81), with Rivermead Behavioral Memory Test (r = 0.47).[9]
- Predictive validity is demonstrated in a number of studies.[21–24] Time since injury and staff-rated MPAI-4 were significant predictors of vocational independence scale scores ($P < 0.01$), staff-rated MPAI-4 was also predictive of time to placement ($P < 0.001$)[22]; staff MPAI-4 ratings contributed significantly to the prediction of community-based employment at 1 year follow-up ($P < 0.01$[24]).

Selected References

Malec JF. The Mayo-Portland Participation Index: a brief and psychometrically sound measure of brain injury outcome. *Arch Phys Med Rehabil*. 2004;85:1989–1996.

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Malec JF, Lezak MD. *Manual for the Mayo-Portland Adaptability Inventory (MPAI-4) for Adults, Children and Adolescents.* San Jose, CA: The Center for Outcome Measurement in Brain Injury. Revised 2008.

PARTICIPATION OBJECTIVE, PARTICIPATION SUBJECTIVE

Purpose/Description

The POPS is a 26-item instrument used to obtain the patient's as well as a societal/normative perspective for commonly occurring social activities.[10] Each of the items in the instrument is addressed with two sets of questions, which are organized into five subscales:

1) domestic life,
2) major life areas,
3) transportation,
4) interpersonal interactions and relationships, and
5) community, recreational, and civic life.

The POPS focuses on activities related to community functioning, generates the objective measure of participation and subjective measure of participation, gauges performance in terms of level of engagement, and incorporates patient preferences for individual satisfaction with his or her level of engagement and determination of importance of each activity. Creation of the subscales was based on the *International Classification of Functioning, Disability, and Health* model.[25]

Recommended Instrument Use: Practice Option

This assessment shows how a patient perceives his or her socialization. For individuals with c/mTBI, this assessment can be administered during initial evaluation. The POPS can also be readministered prior to discharge from therapy services to determine if changes have occurred in community functioning.

Administration Protocol/Equipment/Time

This assessment is administered via in-person interview. The 26-item instrument is available online. Administration time is not estimated on the website; however, the POPS can be completed in a relatively short amount of time.[10] Training and testing information is not yet available.

Groups Tested With This Measure

The POPS was developed from a multifocus research instrument, Living Life After Traumatic Brain Injury (LLATBI).[26] The LLATBI was used in multiple studies involving individuals with TBI and those without disabilities at Mount Sinai School of Medicine. The number of participation items on the LLATBI was reduced, and the POPS was developed.[10] It has been used clinically and in research to measure the outcomes of TBI interventions across the severity range, including mTBI, specifically at the level of participation at home and in the community.[10,27]

Interpretability

- Norms: LLATBI data were gathered on 454 individuals with TBI living in the community and on 121 individuals with no disability.[26]
- Scoring: Brown[10] reports that hour and frequency items are converted to base scores, which are then converted to standardized z-scores. The z-scores are weighted against mean importance ratings of the TBI sample and non-disordered sample for each item. The patient's total participation objective (PO) score is calculated as the average of the weighted z-scores for the 26 items.[10] The participation subjective (PS) score is determined by multiplying the patient's importance score by his or her satisfaction score (ranging from + 4, "most important," to – 4, "least important").[10] The patient's PS total score is the mean across the 26 activities.
- MDC: not available
- Responsiveness estimates: not available

Reliability Estimates

Adequately assessing the reliability and validity of the POPS is complex because the instrument provides both objective descriptive data as well as subjective data.[10]

- Internal consistency: not available
- Interrater: not applicable
- Intrarater: not applicable
- Test-Retest: Repeated measures of the POPS 1 to 3 weeks apart on a subsample of 65 people with TBI resulted in ICC scores ranging from 0.37 to 0.89, and the total PO score was 0.75. The ICC score of the total PS score was 0.80.[10]

Validity Estimates

- Content/Face: not available
- Criterion: not available
- Construct: This was not assessed, as Brown et al[28] determined that no measure provides a "gold standard" for comparison with the POPS at this time. Instead, Brown et al[28] developed a series of expectations of how PO and PS scores should perform if they are validly reflecting the constructs targeted by the items. The authors stated that strong support was found in the data for the expectations.

Selected References

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World Health Organization. *International Classification of Functioning, Disability and Health*. Geneva, Switzerland: World Health Organization; 2001.

WHO-QUALITY OF LIFE-BREF

Purpose/Description

The World Health Organization Quality of Life abbreviated version (WHOQOL-BREF) is a quality-of-life assessment that measures the impact of disease and impairment on daily activities and behavior, and includes measures of perceived health and disability or functional status. It assesses the individual's perceptions in the context of their culture, value systems, and personal goals, standards, and concerns. The WHOQOL-BREF includes 26 questions derived from the original WHOQOL-100 assessment[29–32] that measure the four broad domains of physical health, psychological health, social relationships, and environment. All items are rated on a 5-point scale (1 to 5).

Recommended Instrument Use: Practice Option

This WHOQOL-BREF has both clinical and research applications. It can help clinicians make judgments about the areas in which a patient is most affected by disease, treatment decisions, and to measure change in quality of life over the course of treatment. Following a review of the literature on quality-of-life assessment after TBI, an international TBI consensus group recommended the WHOQOL based on its feasibility, specificity, validity, comprehensiveness, norms psychometric quality, and international availability.[33] Research applications include clinical trials and health policy research. The WHOQOL-BREF is available in 19 languages. For further recommendations, see the WHOQOL-BREF website (www.who.int/mental_health/media/en/76.pdf).

Administration Protocol/Equipment/Time

The WHOQOL-BREF is a self-administered questionnaire; if necessary, interviewer-assisted or interview-administered forms may be used. It uses a 5-point Likert scale ranging from 1 (not at all) to 5 (completely) to answer questions based on experiences over the preceding 2 weeks. It requires 10 to 15 minutes to administer. When completed by a patient or family member, it may take 6 to 30 minutes.

Groups Tested With This Measure

The WHOQOL-BREF has been tested on adults age 18 years and older from many different populations across the world, as well as on individuals with different disorders, including spinal cord injury,[34,35] TBI across the severity range,[36,37] stroke,[38,39] dementia,[40] other neurological illnesses, human immunodeficiency virus,[41] cancer,[42] chronic pain,[43] depression,[44] and community-dwelling older adults.[45]

Interpretability

- Norms: Norms are available for different cross-cultural groups of people with various diseases. See the Rehabmeasures.org website for further reading (www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=937)
- MDC: not established
- Responsiveness estimates: not available

Reliability and Validity Estimates

- Internal consistency reliability: As a measure of the scale's internal consistency, for the total sample, values for Cronbach's alpha were acceptable (greater than 0.7). Across sites, results were consistently high, with most of the alphas above 0.75, and in the range of 0.51 to 0.77. Alpha analyses showed that all 26 items made a significant contribution to the variance in the WHOQOL-BREF. The universality of the WHOQOL-100 was examined in several ways and was found to be remarkably adept at identifying facets of quality of life that are cross-culturally important.[11,46]
- Test-retest: WHOQOL-100 reliability was excellent in a sample of individuals with multiple diagnoses across seven domains: 1) physical, 2) psychological, 3) independence, 4) social, 5) environment, 6) spiritual, and 7) general health/global quality-of-life facet.[47] Unpublished data show that test-retest reliability is very good.[46]
- Interrater reliability: The WHOQOL-100 US version was shown to be reproducible (ICC range: 0.83 to 0.96 at 2-week retest interval).[47] In a study of 250 veterans, the WHOQOL-100 ICC ranged between 0.59 and 0.86. In a study to test whether a web version of the WHOQOL-BREF is an alternative to the paper version, the ICC coefficients for test-retest reliability ranged from 0.79 to 0.91. Interrater reliability has been shown to be good in studies conducted in a variety of countries with different populations and disorders, such as Dutch adult psychiatric outpatients,[48] older patients with depression,[49] chronic schizophrenics,[50] caregivers, and stroke survivors.[51]
- Parallel-form reliability: no parallel form available
- Discriminant validity: The results of a hierarchical multiple regression demonstrated a small but significant impact by age and gender on domain scores between sick and well people ($F = 96.3$ [2,7007], $P < 0.0001$)[52]
- Construct validity: Analysis of correlations showed that in the total population, only seven items had strong correlations (greater than 0.50) with domains other than their intended domain. Summary Pearson correlations (one-tailed test) between domains for the total sample were strong, positive, and highly significant ($P < 0.0001$), ranging from 0.46 (physical).[43]

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THE AMERICAN SPEECH-LANGUAGE-HEARING ASSOCIATION NATIONAL OUTCOMES MEASUREMENT SYSTEM

Purpose/Description

The ASHA NOMS[12] was designed to develop a national database of functional treatment outcomes for speech-language pathologists and audiologists to use to measure the effects of therapeutic interventions from admission to discharge and compare their outcomes against similar patient populations across the country.

The NOMS consists of 15 disorder-specific Functional Communication Measures (FCMs). Each FCM has a 7-point rating scale ranging from least functional (level 1) to most functional (level 7). The ratings do not depend on particular formal or informal assessment measures, but are determined by clinical observations of the patient's performance in functional contexts. FCMs are scored only if they specifically relate to the patient's individualized treatment plan and goals. The FCMs relevant to c/mTBI include: attention, fluency, memory, pragmatics, problem solving, reading, spoken language comprehension, spoken language expression, and writing.

Recommended Instrument Use: Practice Option

The FCMs were designed to describe changes in abilities over time, from admission to discharge. The ASHA NOMS can be used to examine individual and institution-specific treatment outcomes of patient populations as well as to collect aggregate data from across institutions nationally. FCMs are selected based on the areas targeted in the treatment plan and scored by a certified speech-language pathologist. The ASHA NOMS provide the only functional assessment of cognitive-communication intervention that offers a national database for comparing treatment outcomes of patients with acquired c/mTBI and program outcomes with national outcomes of a similar patient population.

The Centers for Medicare and Medicaid Services classified the NOMS as an approved registry through which eligible speech-language pathologists can report on the quality measures for its Physician Quality Reporting System.

Administration Protocol/Equipment/Time

The FCMs do not depend on other formal or informal test results, but are based on observations of the patient. There are a total of 15 FCMs that can be downloaded from the ASHA website (www.asha.org/members/research/noms). It will take a clinician approximately 2 hours to review the training materials and take the user registration test. There is no cost associated with the training or registration test.

Groups Tested With This Measure

Data collection is ongoing for adults in healthcare settings and includes individuals with mild and moderate TBI.

Interpretability

- Norms: unavailable
- Scoring: Each FCM has a 7-point rating scale ranging from least functional (level 1) to most functional (level 7).
- MDC: Data are being collected; however, patients with c/mTBI can possibly move from level 5 to level 7.

Reliability and Validity Estimates: No information is available.

- Responsiveness: The responsiveness of nine outcomes measurement scales was evaluated with 33 children and adolescents (ages 4–18 years) who had sustained TBI. The ASHA NOMS was sufficient to detect change in each of the children where change occurred.[53]

Selected Reference

American Speech-Language-Hearing Association. *National Outcomes Measurement System (NOMS): Adult Speech-Language Pathology User's Guide.* Rockville, MD: ASHA; 2003.

GOAL ATTAINMENT SCALING

Purpose/Description

Goal attainment scaling (GAS) produces an individualized, criterion-referenced measure of a person's goal achievement that can be aggregated to quantify summary outcomes across patients receiving the same intervention but who have different individual goals.[54,55] Additionally, rather than simply reporting whether or not goals were achieved, GAS provides the clinician information about the degree of goal achievement associated with a given intervention or experimental condition. Some experts recommend GAS as a responsive and reliable metric of cognitive rehabilitation outcomes.[56]

Recommended Method Use: Practice Option

GAS allows clinicians to evaluate the extent to which a group of patients who are receiving the same type of intervention achieve their personal rehabilitation goals. Therefore, use of this method is most appropriate for clinicians who treat a number of service members with c/mTBI. GAS is described as specific to each patient.[57] Therefore, it can be used in heterogeneous populations, including patients with different severity levels of TBI or those with comorbidities. Individual patient goals are set and can be weighted to reflect the opinion of the patient and the therapist or team on the difficulty of achieving the goal.[58] According to Malec,[56(p235)] GAS can be used beneficially for:

- monitoring progress in a time-limited epoch of care;
- structuring team conferences;
- planning and making decisions about ongoing rehabilitation;
- ensuring concise, relevant communication to the client, significant others, referral source, and funding sources;
- guiding the delivery of social reinforcement; and
- evaluating the program.

Used in conjunction with other outcome measures, GAS has been shown to effectively measure outcomes of cognitive-communication intervention. It was one of six main outcome measures used in a randomized controlled trial designed to evaluate the efficacy of a group treatment program addressing social communication skills training for people with TBI.[59] Each goal was expressed objectively in terms of concrete behaviors that can be observed and recorded. Goals were developed with input from the individual participant and assistance from the group leader. The goals were scaled into five steps, so the participant usually fell at the second step, with a chance to achieve one, two, or three steps toward maximum goal achievement as rated by themselves, the group leaders, and a significant other. After setting specific social communication goals in the third week of treatment, goal attainment was evaluated at the end of treatment and at 3-, 6-, and 9-month follow-ups by the TBI subject, significant others, and the group leaders. A sample of the GAS for this study follows:

GOAL: *I will ask more questions in conversations*.

1. I will ask questions in 10% or less of conversations.
2. I will ask questions in 30% of conversations.
3. I will ask questions in 50% of conversations.
4. I will ask questions in 70% of conversations.
5. I will ask questions in 90% or more of conversations.[56(p253)]

Note that GAS requires familiarity with statistical calculations. Therefore, use of this method may only be appropriate in settings in which statistical support or consultants are available.

Administration Protocol/Equipment/Time

See Clinician Tip Sheet: GAS Procedures for a description of the process. Identifying client goals may be incorporated into the interview/evaluation process, adding up to 15 minutes to formalize the five levels of goal achievement used in GAS. No formal materials or equipment are needed.

Groups Tested With This Measure

Originally developed to measure outcomes in mental health,[60] GAS has been used to measure change as a result of cognitive rehabilitation[61] and brain injury rehabilitation,[21,62] including in those with c/mTBI,[55,63] and has been recommended as a useful outcome and planning tool in cognitive rehabilitation after c/mTBI.[59,64]

TABLE 11-1

EXAMPLE GOAL ATTAINMENT SCALE: IMPROVING APPOINTMENT ATTENDANCE

Predicted Attainment	Score	Goal Attainment Levels
Most favorable outcome likely	+ 2	Arrives at medical appointments on time without any reminders from wife.
Greater than expected outcome	+ 1	Arrives at medical appointments on time with occasional reminders from wife.
Expected level of outcome	0	Arrives at medical appointments on time with one morning reminder from wife on the day of the appointment.
Less than expected outcome (and baseline/evaluation performance)	– 1	Arrives at medical appointments on time with multiple reminders from wife on the day of the appointment.
Most unfavorable outcome	– 2	Arrives at medical appointments on time only if driven by wife.

Interpretability

- The goal attainment standardized score has a mean of 50 and a standard deviation of 10. A *t*-score of greater than 50 reflects performance that is above the expected level; less than 50 reflects performance that is lower than the expected level of achievement.[65]
- Responsiveness: Findings from multiple studies suggest that GAS is more sensitive than traditional rehabilitation measures.[61,66,67]

Reliability and Validity Estimates

- Interrater reliability: Various aspects of GAS interrater reliability have been examined.
  - Goal identification: Rushton and Miller reported that 63% of goals were identified by two different investigators in patients with lower extremity amputations.[67]
  - Scale items: Joyce et al[68] reported high levels of agreement when two raters ranked the same scale items (– 2 to + 2; r = 0.92 to 0.94).
  - Outcome goal achievement scoring: Goal scales scores assigned by therapists working with children with cerebral palsy had good correlation (Cohen's kappa = .64) with scores assigned by independent raters.[69]
- Validity: Convergent validity was evaluated in a brain injury rehabilitation program. GAS was highly correlated with global clinical impressions (Pearson correlation = 0.8061) but modestly correlated with other measures (eg, – 0.6162 with the Rappaport Disability Rating).

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CLINICIAN TIP SHEET: GAS PROCEDURES

Step 1: Establish competency in GAS.[70]

- Persons experienced in GAS should provide instruction and examples for those new to the method. Novice users of GAS should establish practice GAS levels, which are then reviewed by experts.
- If multiple clinicians at a given site are

developing GAS, procedures should be established for consistency to ensure similar increments for scaling.[70]
- Consult with a statistician to set up data analysis methods.

Step 2: Identify problem areas and related therapy goals.[54,55]

- Via an interactive interview, the patient identifies problem areas of concern and behaviors that should be addressed to resolve the concern.
- Trombly[63,71] used the Canadian Occupational Performance Measure to identify five goal areas, which became the basis for individualized GAS.

Step 3: Specify levels of performance.

- Goal-related behaviors or events are operationalized[54] (Table 11-1).
- Collaborate with the patient in this process to specify goal levels.

Step 4: Ensure there are no overlapping levels, gaps between levels, or more than one indicator in a problem area.[54]

Step 5: Plan a reevaluation strategy and timeframe. Consider revisiting status towards goal achievement with the patient at least once a month.

Step 6: Calculate the GAS score.

GAS is a valuable and rigorous method for evaluating patients' goal achievement. This method allows clinicians to evaluate goal achievement by aggregating GAS across multiple patients to determine if the group experienced statistically significant pre-post changes. Clinicians should collaborate with a statistical expert to set up methods to calculate GAS scores and analyze GAS data.[54]

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