J Rehabil Med 2011; 43: 8–14

SPECIAL REPORT

PRACTICAL CONSIDERATIONS FOR GOAL ATTAINMENT SCALING DURING REHABILITATION FOLLOWING ACQUIRED BRAIN INJURY

Per Ertzgaard, MD[1], Anthony B. Ward, BSc, MD, FRCPEd, FRCP[2], Jörg Wissel, MD[3] and Jörgen Borg, MD[4]

From the [1]Department of Rehabilitation Medicine, Linköping University Hospital, Linköping, Sweden, [2]North Staffordshire Rehabilitation Centre, Haywood Hospital, Stoke on Trent, UK, [3]Kliniken Beelitz GmbH, Clinical Department of Neurological Rehabilitation, Beelitz-Heilstaetten, Germany and [4]Department of Clinical Sciences, Karolinska Institutet, Rehabilitation Medicine, Danderyd Hospital, Stockholm, Sweden

Objective: **Goal attainment scaling represents a unique approach to identifying and quantifying individualized, meaningful treatment outcomes, and its use in the rehabilitation medicine setting is increasing. The aim of this paper is to discuss the available literature for goal attainment scaling in patients with acquired brain injury, in terms of its advantages, disadvantages and practical application, including examples of goal setting and scaling.**

Key words: acquired brain injury; goal attainment scaling; rehabilitation.

J Rehabil Med 2011; 43: 8–14

Correspondence address: Per Ertzgaard, Department of Rehabilitation Medicine, Linköping University Hospital, SE-581 85 Linköping, Sweden. E-mail: Per.Ertzgaard@lio.se

Submitted January 4, 2010; accepted November 26, 2010

INTRODUCTION

Although a wide range of validated outcome measures are available in brain injury rehabilitation, only a few capture the key effects of intervention at the individual level in patients with heterogeneous and often complex disabilities. Goal attainment scaling (GAS) represents one approach to identifying and quantifying individualized, meaningful treatment outcomes, and there is now increasing documentation of its use in the rehabilitation medicine setting.

GAS was developed initially as a comprehensive measurement of the effects of interventions on behaviour in community mental health programmes (1). A key feature of GAS is that, rather than simply identifying whether a pre-defined goal has been achieved, it allows quantification of goal achievement, e.g. exceeding expectations, improvement without meeting expectations, or even deterioration from baseline (2). The first outcome may indicate that not only has the goal been achieved, but that this has occurred with less support, in a shorter time period or at a higher frequency than anticipated.

GAS has also been shown to lend itself well to measuring longitudinal changes in activity (i.e. functional gain) in those individuals who experience disability following acquired brain injury (ABI), e.g. stroke or head trauma (3–5). This is due, at least in part, to the fact that the heterogeneity of such patients (with respect to aetiology, severity and disability) makes the use of global outcome measures, e.g. Barthel Index (BI), Functional Independence Measure (FIM™), difficult (6). Indeed, GAS is particularly relevant in ABI rehabilitation, as patients need to identify individual goals and then plan and manage their own goal-directed behaviour, which requires utilization of executive functions (4, 7). Furthermore, GAS allows individualization of goals according to patient needs and expectations, with the overarching aim of increasing the individual's ability to be engaged in activities that are meaningful to them (8). These goals may therefore encompass everyday activities, self-care or other targets and can represent multiple domains (e.g. health, social, personal) and at different levels (9, 10). GAS is therefore applicable across conditions and severities of disability, with goals being set in conjunction with the carer and therapists in order to ensure that they are realistic and feasible for the individual (8, 10). The goals identified are then used to guide the selection and implementation of subsequent therapeutic interventions and the extent of goal attainment is scaled (2, 10). Scaling has most often been done by use of a symmetrical 5-point scale, as originally suggested (1) and designed to allow statistical data analysis. This scale typically comprises 2 attainment levels below (−2 and −1) and 2 levels above (+1 and +2) the expected outcome level (0), where −1 or −2 denotes a little or much less than the expected level of attainment, respectively, and +1 or +2 correspondingly denotes a little or much more than the expected outcome (2, 11–15). This allows the calculation of an aggregated T-score (2, 12, 16), which takes into account the attainment of several goals as well as their relative weight, i.e. their importance to the patient and their difficulty in achievement according to the clinician, which might also be rated on a 5-point scale. Another approach is to use 6 outcome levels, including a rating of −3 to document of a state of deterioration from baseline. There are advantages and disadvantages with each of these approaches (11, 17, 18), as discussed below. In this paper, a 6-point scale is used for illustration (Table I).

The objective of this paper is to explore the advantages and disadvantages of using GAS as an outcome measure in patients with ABI undergoing a rehabilitation programme and to highlight the practical issues and challenges associated with this methodology.

© 2011 The Authors. doi: 10.2340/16501977-0664
Journal Compilation © 2011 Foundation of Rehabilitation Information. ISSN 1650-1977

Table I. *A 6-point Likert scale for goal attainment scaling*

−3[a]	Goal not achieved (deterioration from baseline level)
−2	Goal not achieved (much less than expected level of outcome)
−1	Goal not achieved (less than expected level of outcome)
0	Goal achieved (expected level of outcome)
1	Goal achieved (better than expected level of outcome)
2	Goal achieved (much better than expected level of outcome)

[a]This is in addition to the most widely-used form of such scales, which are rated from −2 to +2.

LITERATURE REVIEW

The objective of the review process was not to perform a conventional systematic review of the evidence, but to extract the most pertinent information from the available literature regarding how GAS has been used in practice in the ABI rehabilitation setting and to summarize some related observations. Conclusions of selected studies are reported as they are presented in their respective publications. The authors also include some examples for goal setting and scaling from their own clinical experience.

ADVANTAGES OF USING GOAL ATTAINMENT SCALING AS AN OUTCOME MEASURE

Numerous studies have compared GAS with other measures of clinical and functional outcome in ABI patients undergoing rehabilitation. In a retrospective analysis of 18 patients with spasticity related to ABI, outcome GAS score was significantly higher in those considered to have achieved a clinical response according to clinician-rated standard measures of functional status than in non-responders (19). Furthermore, GAS score reflected changes in focal outcomes that were not apparent when evaluated using the BI, which is a global measure of functional outcome. In a recent *post-hoc* analysis of a randomized, double-blind, placebo-controlled trial evaluating the effects of botulinum A toxin therapy, GAS outcome T-scores were strongly correlated with a reduction in post-stroke spasticity (12). In a separate study involving 24 adults with multiple sclerosis, a close relationship between GAS scores and response according to Clinical Global Impression (CGI; as assessed by the physician) was observed (13). When comparing responders and non-responders according to CGI, GAS was more sensitive than either the BI or FIM in separating these 2 groups of patients, when considering statistically or clinically significant differences. In an analysis of patients with ABI spanning a 10-year period who participated in the Mayo Brain Injury Outpatient Program, GAS T-score (calculated using the combination of 5 scores for each patient) was found to be strongly correlated with both Independent Living Status and Vocational Independence Scale scores (3). These correlations were observed at discharge from the programme and at one-year follow-up. However, in 45 patients with stroke undergoing inpatient rehabilitation, no significant correlations between median GAS score and FIM-motor, depression (as measured by the Centre for Epidemiological Studies Depression Scale), or self-care self-efficacy (as measured by Strategies Used by Patients to Promote Health scale) scores were observed immediately prior to discharge (16). A more recent prospective analysis of data from 164 patients undergoing rehabilitation (66% following stroke) has demonstrated that GAS is moderately correlated with changes in FIM and BI. However, more than one-third of all goals set for these patients were within areas outside the domains covered by these scales, indicating the broader spread of gains as measured by GAS (20).

As GAS is specific to each patient, it can be used in heterogeneous populations, e.g. those with spasticity caused by different pathologies and those with differing severities of impairment (8). For example, patients suffering from cerebral infarction, brain haemorrhage and traumatic brain injury may all be evaluated using the same methodology (21). Furthermore, GAS may also be used to evaluate increases or decreases in a pre-specified outcome, e.g. improved ease of washing under the arms or reduced difficulty in dressing (22). It therefore focuses on improvements in activity and participation rather than changes in disability.

Goal attainment is apparently not influenced by demographic factors, e.g. sex, hand dominance, or by diagnosis (21, 23). In particular, GAS has demonstrated its validity in measuring changes in functional status in both adults and children. Indeed, numerous studies have evaluated changes in mobility and balance in children with cerebral palsy-associated spasticity using GAS (17, 24–26).

Self-selection of goals by patients with ABI may be associated with enhanced motivation to practice the related activity (8). This may take the form of an activity that enhances the individual's appearance, facilitates the undertaking of other activities, or increases their independence. For example, Table II focuses on the ability to walk unaided a short distance to a specific location, with goal achievement according to the time

Table II. *Example: Walking speed. This example refers to a 72-year-old man who had a stroke 19 months earlier. He lives with his wife, and their daughter lives with her family approximately 600 m away. He enjoys spending time with his grandchildren and has a strong desire to improve his walking distance in order to visit them. He presents with a chronic, left-sided hemiparesis with minimal voluntary control and increased flexor muscle tone in the upper extremity, increased extensor muscle tone in the lower extremity and a typical gait pattern with circumduction during the swing phase, and supination of the left foot and hyperextension of the left knee during standing*

−3	Walking to daughter's home (600 m) without walking aids in more than 45 min
−2	Walking to daughter's home (600 m) without walking aids in 45 min
−1	Walking to daughter's home (600 m) without walking aids in less than 45 min, but more than 35 min
0	Walking to daughter's home (600 m) without walking aids in less than 35 min but more than 25 min
1	Walking to daughter's home (600 m) without walking aids in less than 25 min, but more than 20 min
2	Walking to daughter's home (600 m) without walking aids in less than 20 min

taken. Goal setting therefore allows a patient's individualized wishes, aspirations and expectations to be established and acknowledged.

When using GAS, an individual can set as many or as few goals as desired, with a single numerical outcome (the GAS T-score) (11). This provides a means of statistically comparing outcomes (change) for multiple goals and across functional domains in the rehabilitation setting (e.g. at admission vs following intervention and at later follow-up), while retaining individual treatment goals (3, 13). A recent *post-hoc* analysis of data from a study involving patients with post-stroke spasticity has demonstrated that there is a strong correlation between T-scores and GAS change scores (12). The inter-rater reliability of GAS has been demonstrated as high, with correlation coefficients greater than 0.90 (14, 27). However, it should be pointed out that the construct validity of GAS measurement remains a challenge (28).

From the therapist's perspective, GAS may furnish a greater understanding of patient needs and expectations of their rehabilitation programmes (2). The requirement for goal identification, setting and scoring can also enhance communication and collaboration between members of the multidisciplinary rehabilitation team (11). Additionally, it may facilitate ongoing rehabilitation planning and decision-making (29). Outcomes according to GAS are also of relevance to hospital or rehabilitation service managers, as they may enhance identification of successful interventions and allow provision of appropriate and more cost-effective care.

DISADVANTAGES OF USING GOAL ATTAINMENT SCALING AS AN OUTCOME MEASURE

A number of significant limitations in using GAS within the ABI rehabilitation setting have been identified. In patients with severe cognitive or behavioural impairments, goals cannot be set by the individual themselves; assumptions regarding their needs and wishes have to be made by their carer or therapist (21). This is the same for global measures of disability, but lack of insight and difficulties in communication can additionally prolong the goal setting procedure to such an extent that the number of goals that can be set is substantially reduced (30). Furthermore, lack of insight may be associated with a patient's desire to set unrealistic goals for themselves. Such patients may also often be unable to achieve pre-defined goals or recognize and rate their achievements due to their impairments. In particular, deficits in attention, concentration, memory and visual-spatial performance have been associated with not achieving goals in patients with ABI (31).

The use of minus figures when a goal is not achieved may be demoralizing or discouraging for patients (11). During follow-up, patients may therefore provide "desirable" answers rather than those that reflect their actual level of goal attainment (30). This is a particular problem when follow-up is conducted by telephone and assessment of non-verbal cues is not possible.

Goal setting and scaling are skills that must be learned, as establishing agreed goals and predicting outcomes may not be part of routine clinical practice (19). For the individual therapist, first instances of goal setting and devising the associated scales may prove to be very time-consuming and difficult when compared with the administration of other outcome measures, and the learning curve may be steep (15, 30, 32). The reliability and validity of the scales and scores may therefore vary according to the experience of the individual developing these (15). In particular, if the scaling is not devised appropriately, apparently clinically meaningful change scores according to GAS may be recorded, which are not borne out by clinical observation or experience (28). This may be, at least partly, due to the differences in perception of goal attainment between patients or carers and therapists. A period of formal training covering the goal setting and scaling procedures prior to using GAS in clinical practice is therefore necessary (15).

PRACTICAL ASPECTS OF USING GOAL ATTAINMENT SCALING IN THE REHABILITATION SETTING

Goal setting

Goals set must be realistic for the individual patient; challenging but achievable. Factors to be considered prior to commencing goal setting include the patient's impairments (including cognitive impairment), the presence of any co-morbidities, their ability to communicate, living arrangements and availability of assistance. Activity prior to the brain injury may be used as a guide, but patients must be aware that regaining complete pre-insult function may not be possible and that sedentary goals may be more achievable than more strenuous ones (33). However, each goal must still be of interest and relevant to the patient and reflect their expectations, wishes and priorities (2). The wishes and expectations of carers and family members should also be considered, e.g. setting a goal that may reduce their caring burden. From the clinician's perspective, goals must also be realistic in relation to the planned intervention, i.e. they must not extend beyond the established scope of any rehabilitation methods that will be employed (Table III) (30). It may be useful to review goals during multidisciplinary team meetings in order to gain broader input regarding the accuracy of predictions for a patient to return to certain aspects of their previous lifestyle and abilities (16).

Table III. *Example: Aided walking*

−3	Walking indoors with a walking frame for less than 50 m under supervision and with some support for balance
−2	Walking indoors with a walking frame for less than 50 m under supervision but without need for support for balance (baseline)
−1	Walking indoors with a walking frame less than 50 m independently
0	Walking indoors with a walking frame more than 50 m independently
1	Walking indoors with a walking frame more than 100 m independently
2	Walking outdoors with a walking frame more than 100 m independently

A number of pre-existing lists and measures can provide the basis for goal setting during discussions with the patient and can also reduce the time required for the goal setting procedure (34). The Canadian Occupational Performance Measure can be used to select problems that are important to the patient with ABI and ones that they feel they perform poorly at (35, 36). These include self-care, mobility, productivity and social skills. The patient firstly rates the importance of each problem on a 10-point scale. They then rate (in a similar way) their ability to perform their most important problems and their satisfaction with their performance. Taken together, these ratings can form the basis of their goals (5). The Rehabilitation Activities Profile, which consists of 5 domains (communication, mobility, personal care, occupation and relationships) may also be used in a similar manner for goal identification (34).

The International Classification of Functioning, Disability and Health (ICF) Core Set for stroke provides a comprehensive list of body functions, body structures, activities and environmental factors that may be altered or problematic following a cerebrovascular event (37). With respect to active functional goal setting, Chapters 4, 5 and 6 within the categories of activities and participation may be most relevant for use in discussion with patients. A recent study involving patients with post-stroke spasticity confirmed that the majority (> 70%) of goals set concerned activities and participation; the remainder covered body functions, such as pain (12). Although such lists can form the basis of discussions about goal identification, they only provide general, broad-based items, e.g. dressing, washing. For the purposes of GAS; however, goals must be specific, aimed at activity rather than system function and details should be included, e.g. "brushing hair with right hand" rather than "using right hand in daily grooming" (2, 19).

Once goals have been identified, they may also be weighted according to their difficulty (as rated by the clinician) and importance (as rated by the patient). Each of these can be scored from 1 (a little) to 3 (very), with consistent weighting for all goals set for the individual patient, or for all patients if comparisons are to be made (2, 14). The importance of specific individual goals to a patient determines the level of activity and effort required and willingness to achieve them (i.e. adjustment or scaling of effort) (33). However, weighting goals is not an essential part of undertaking GAS and may even be considered as an unnecessary complication of the procedure, especially in real-life clinical practice (2).

The timeframe within which goals should be achieved and assessed must also be determined. As behavioural change takes time, short-term targets are generally set at 4–6 weeks (2, 14). However, changes in physical status, such as activity improvements following intervention in patients with post-stroke spasticity, may be assessed after 12 or 16 weeks (13, 22, 38). When considering changes in activity in patients with cognitive impairment following ABI, a longer timeframe may be required, e.g. 6 months (30).

The number of goals set is determined by a number of factors. In patients with cognitive impairments, the time taken to identify and set goals may be increased; therefore, setting a maximum of 2 or 3 goals within 30 min may be feasible (30). For most patients with ABI, 3–5 goals represent a feasible number to scale and record, while capturing the patient's key priorities (19, 30).

The actions or interventions and support required to achieve the goal(s) must also be identified. This may include physical or other aids (e.g. adapted cutlery, walking stick), practical or physical support (e.g. cutting food, assisting with walking) or emotional support (e.g. to increase self-confidence) (2). Depending on the patient's cognitive status, prompts and reminders may also be required, e.g. a sequential list of actions, signposting for orientation. In addition, the resources required for goal attainment must be checked against the resources available within the rehabilitation and patient's home environments. As part of the rehabilitation process, patients with ABI must learn goal-directed strategies and problem-solving skills following goal setting and practice these regularly (8, 9, 39).

Goal attainment scaling

GAS has most often utilized a 5-point scale, which is supported by a wealth of clinical data. As it is symmetrical, the 5-point scale is designed to demonstrate a normal distribution of outcome T-scores, thus allowing statistical analysis by parametric methods (1), although this approach has been questioned. The use of outcome T-scores assumes that goals are set in an unbiased fashion, with achievements exceeding and falling short of expectations in approximately equal proportions, in order to demonstrate a normal distribution with a mean of 50 and standard deviation of 10 (1). This may not always be the case, as T-scores are strongly influenced by the difficulty and realism of the goals set (and the experience of the clinician) (12, 20). Furthermore, this approach also assumes that the intervals between ratings are equal rather than simply an ordinal scale of value judgements (17, 18), thus bringing into question the validity of parametric statistical tests to make comparisons between populations or baseline and endpoint states. Calculation of T-scores also requires complex mathematical manipulation of data, which is often not feasible in the everyday rehabilitation clinic setting. There are also significant limitations of GAS measures with regard to their underlying mathematical validity as demonstrated by Tennant (28).

A recent *post-hoc* analysis of clinical trial data has demonstrated that a change from baseline of 6 in GAS outcome T-score predicted a response to botulinum A toxin therapy, even when the calculated outcome T-score was somewhat lower than the assumed mean of 50 (12), indicating that change scores may be more useful. A GAS change score ≥ 10 also predicts clinician-rated clinical response to intervention in patients with ABI with a sensitivity of > 90% and a specificity of > 85% (19). Furthermore, the rating of −2 in the 5-point scale assumes that no clinically worse outcome, i.e. deterioration from baseline, is possible (14), but in some studies patients with ABI have been considered as meeting the rating of −1 or −2 at baseline, indicating a mixed group and perhaps skewing potential outcomes (30). This may be overcome by use of a 6-point verbal scale with patients, with ratings of: worse; no change; partial achievement; expected achievement; achievement a little better than expected; achievement a lot better than expected (40).

Table IV. *Example: An ambiguous goal*

−3	Cannot use left hand to support the plate
−2	Uses left hand to support the plate. Holds both fork and knife with right hand for cutting food and eating (baseline)
−1	Can hold the fork with left hand but does not manage to support the food on the plate while cutting it with right hand. Uses the right hand for both cutting and eating
0	Can hold the fork in left hand while cutting "softer food" (e.g. potatoes) with right hand. Holds the fork with right hand while eating
1	Can hold the food on the plate with the fork in left hand while cutting all food with right hand. Holds the fork with right hand while eating
2	Can hold the food on the plate with the fork in left hand while cutting all food with right hand. Holds the fork with left hand while eating

This can then be mapped to the 6-point scale incorporating the −3 rating, where −1 represents partial achievement from baseline (set as −2).

The added rating of −3 may be useful in the clinical trial setting, when evaluating the effect of a specific intervention and this has been used successfully in children with cerebral palsy (17, 18, 32). However, as the 6-point scale is asymmetrical, calculation of outcome T-scores and their statistical analysis will be more challenging than use of the 5-point scale (17), but it should be borne in mind that calculation of a T-score may actually be unnecessary or undesirable in clinical practice (18). Additionally, as the majority of the literature reports findings using the 5-point scale, results from studies using the 6-point scale may be difficult to compare. Furthermore, distinct definition of a state of deterioration may prove difficult (17). At present, it may be viewed that the 5-point scale is more relevant for clinical practice, while the 6-point scale has greater applicability in the clinical trial setting.

A recent publication has compared the use of 5- and 6-point scales in patients with ABI (40). Two different 6-point scales were applied retrospectively to clinical data originally prospectively assessed using a 5-point scale: (*i*) all baseline scores were set at −2, with −3 representing deterioration; (*ii*) a −0.5 rating was introduced to the pre-existing 5-point scale to denote "partial achievement" for goals starting at −1. Baseline scores were similar for the 5-point scale and the second 6-point scale, but lower for the first 6-point scale. Median outcome T-scores were 50.0 for all 3 scales. However, the first 6-point scale appeared to have underestimated goal achievement, whereas the second 6-point scale seemed to marginally overestimate goal attainment compared with the 5-point scale. The authors concluded that the second 6-point scale provided the closest approximation of the 5-point scale but that for analysis and reporting, −0.5 scores should be converted to −1, i.e. to a 5-point scale. Further work is needed in order to evaluate methods of goal setting, scaling and scoring (28, 40).

When devising a scale for each goal, certain factors should be considered. The states above and below the expected outcome must be unambiguous, i.e. discrete, in order to allow accurate measurement of change from baseline and determination of goal achievement. Table IV provides an example of an ambiguous goal; it is actually multiple goals relating to numerous different functions in 2 different limbs (Table IV).

Ideally, the intervals on the scale should be approximately equal, which may be challenging to determine in practice, particularly when concerning activity and participation. An alternative approach is to define the levels of achievement by functionally meaningful outcomes, even if these are not equidistant. Consequently, the results of such scales must be analyzed using non-parametric statistical methods. Perhaps more importantly, devising the scale should be achievable in a reasonably short period of time.

Quantification of performance should be taken into consideration, e.g. the time taken to complete a set quantity of the pre-specified activity; the quantity of activity completed in a pre-specified time; or the frequency of a discrete activity occurring during a pre-specified period. An activity must therefore have a clear start and finish that can be easily observed and recorded (2) (Table V). Alternatively, quality of performance could be assessed, which may include a reduced requirement for help from others or a reduced need for physical aids.

In patients whose stated goal(s) may be unrealistic, this may be taken into account by scaling their expectation as +2 (beyond the level of expectation), with 0 set as the level of goal attainment anticipated by the therapist. This means that the patient's expectations are not totally disregarded (11). Some patients with ABI, especially those with cognitive impairment, may have difficulty with understanding the nature of GAS, i.e. the meaning of the points on the Likert scale. Therefore, verbal explanations of each level of goal attainment should be employed, e.g. "much higher than expected", rather than just +2 (30).

Table V. *Example: Descending stairs*

−3	Unable to descend stairs, or any other deterioration
−2	Descending stairs is difficult (needs 1 min to descend 10 steps) and needs a lot of help from 1 person to prevent foot from pronation/eversion and to help with knee control (baseline)
−1	Descending stairs is easier (needs < 1 min but > 30 s to descend 10 steps) and needs only intermittent help with foot positioning and knee extension in the stance phase
0	Descending stairs is easier (needs only 30 s to descend 10 steps) and needs no help with foot positioning but still a little help for knee control
1	Descending stairs is easier (needs < 30 s but > 20 s to descend 10 steps) and needs no help with foot positioning but needs verbal support for knee control
2	Can descend steps alone, needs < 20 s to descend 10 steps and does not require help from another person

Assessment of goal attainment

Assessment of goal attainment can be performed during multidisciplinary team meetings, or ideally during consultation with the patient (2, 11, 13). When scoring goal attainment, the level of achievement may in fact fall between 2 of the pre-defined states. In such a case, it may be pragmatic to record the level of achievement as the lower of the 2, i.e. the less favourable (2).

In conclusion, GAS measures clinically meaningful change in activity/participation status in patients undergoing rehabilitation for disability caused by ABI. It may provide a more sensitive measure of specific changes than global measurement tools and can allow statistical comparison of outcomes following intervention in heterogeneous populations, while retaining individualized treatment goals, although there are a number of methodological challenges to consider. Several key points must be taken into account when using GAS, including identification of goals that are realistic and of interest to the patient, can be achieved with the resources available and can be scaled and assessed with relative ease. The choice of 5- or 6-point scales may depend upon the rehabilitation setting; i.e. clinical practice or research and there are advantages and disadvantages associated with both approaches. It should also be remembered that GAS does not replace established standardized assessment tools for evaluating ABI rehabilitation outcomes.

ACKNOWLEDGEMENTS

The authors thank Michelle Preston and Right Angle Communications for assistance with preparation of the manuscript, which was funded by Allergan.

Conflicts of interest: Professor Jörgen Borg has been the recipient of honoraria and fees for presentations at meetings and congresses and for participating in Advisory Boards. Professor Anthony B. Ward has participated in research studies, for which an unrestricted grant has been provided by Allergan. He has been the recipient of honoraria and fees for presentations at meetings and congresses and for participating in Advisory Boards. He has also received, in the past, honoraria and fees from Ipsen and Medtronic for presentations at meetings and congresses. Professor Jörg Wissel has participated in research studies, for which an unrestricted grant has been provided by Allergan, Elan, Merz and Ipsen. He has been the recipient of honoraria and fees for presentations at meetings and congresses and for participating in Advisory Boards from Allergan, Eisai, Ipsen, Merz and Medtronic. Dr Per Ertzgaard has been the recipient of honoraria and fees for presentations at meetings and congresses and for participating in Advisory Boards for Allergan. He has also received honoraria and fees from Medtronic for presentations at meetings and congresses.

REFERENCES

1. Kiresuk T, Sherman RE. Goal attainment scaling: a general method for evaluating comprehensive community mental health programs. Commun Ment Health J 1968; 4: 443–453.
2. Bovend'Eerdt TJH, Botell RE, Wade DT. Writing SMART rehabilitation goals and achieving goal attainment scaling: a practical guide. Clin Rehabil 2009; 23: 352–361.
3. Malec M. Impact of comprehensive day treatment on societal participation for persons with acquired brain injury. Arch Phys Med Rehabil 2001; 82: 885–895.
4. Trombly CA, Radomski MV, Trexel C, Burnet-Smith SE. Occupational therapy and achievement of self-identified goals by adults with acquired brain injury: phase II. Am J Occup Ther 2002; 56: 489–498.
5. Ownsworth T, Fleming J, Shum D, Kuipers P, Strong J. Comparison of individual, group and combined intervention formats in a randomized controlled trial for facilitating goal attainment and improving psychosocial function following acquired brain injury. J Rehabil Med 2008; 40: 81–88.
6. Edwards MJ, McNeil JE, Greenwood RJ. Process and outcome during early inpatient rehabilitation after brain injury. Disabil Rehabil 2003; 25: 405–410.
7. Hart T, Evans J. Self-regulation and goal theories in brain injury rehabilitation. J Head Trauma Rehabil 2006; 21: 142–155.
8. Mastos M, Miller K, Eliasson AC, Imms C. Goal-directed training: linking theories of treatment to clinical practice for improved functional activities in daily life. Clin Rehabil 2007; 21: 47–55.
9. Dahlberg CA, Cusick CP, Hawley LA, Newman JK, Morey CE, Harrison-Felix CL, Whiteneck GG. Treatment efficacy of social communication skills training after traumatic brain injury: a randomized treatment and deferred treatment controlled trial. Arch Phys Med Rehabil 2007; 88: 1561–1573.
10. Royal College of Physicians, the Intercollegiate Stroke Working Party. National clinical guideline for stroke. Third edition. London: Royal College of Physicians; 2008, July.
11. Turner-Stokes L. Goal attainment scaling (GAS) in rehabilitation: a practical guide. Clin Rehabil 2009; 23: 362–370.
12. Turner-Stokes L, Baguley IJ, De Graaff S, Katrak P, Davies L, McCrory P, et al. Goal attainment scaling in the evaluation of treatment of upper limb spasticity with botulinum toxin: a secondary analysis from a double-blind placebo-controlled randomized clinical trial. J Rehabil Med 2010; 42: 81–89.
13. Khan F, Pallant JF, Turner-Stokes L. Use of goal attainment scaling in inpatient rehabilitation for persons with multiple sclerosis. Arch Phys Med Rehabil 2008; 89: 652–659.
14. Rockwood K, Joyce B, Stolee P. Use of goal attainment scaling in measuring clinically important change in cognitive rehabilitation patients. J Clin Epidemiol 1997; 50: 581–588.
15. Steenbeek D, Ketelaar M, Galama K, Gorter JW. Goal attainment scaling in paediatric rehabilitation: a report on the clinical training of an interdisciplinary team. Child Care Health Dev 2008; 34: 521–529.
16. Brock K, Black S, Cotton S, Kennedy G, Wilson S, Sutton E. Goal achievement in the six months after inpatient rehabilitation for stroke. Disabil Rehabil 2009; 31: 880–886.
17. Steenbeek D, Meester-Delver A, Becher JG, Lankhorst GJ. The effect of botulinum toxin type A treatment of the lower extremity on the level of functional abilities in children with cerebral palsy: evaluation with goal attainment scaling. Clin Rehabil 2005; 19: 274–282.
18. Steenbeek D, Ketelaar M, Galama K, Gorter JW. Goal attainment scaling in paediatric rehabilitation: a critical review of the literature. Dev Med Child Neurol 2007; 49: 550–556.
19. Ashford S, Turner-Stokes L. Goal attainment for spasticity management using botulinum toxin. Physiother Res Int 2006; 11: 24–34.
20. Turner-Stokes L, Williams H, Johnson J. Goal attainment scaling: does it provide added value as a person-centred measure for evaluation of outcome in neurorehabilitation following acquired brain injury? J Rehabil Med 2009; 41: 528–535.
21. Liu C, McNeil JE, Greenwood R. Rehabilitation outcomes after brain injury: disability measures or goal achievement? Clin Rehabil 2004; 18: 398–404.
22. Ashford S, Turner-Stokes L. Management of shoulder and proximal upper limb spasticity using botulinum toxin and concurrent therapy interventions: a preliminary analysis of goals and outcomes. Disabil Rehabil 2009; 31: 220–226.
23. Prigatano GP, Wong JL. Speed of finger tapping and goal attainment after unilateral cerebral vascular accident. Arch Phys Med Rehabil 1997; 78: 847–852.

24. Mall V, Heinen F, Siebel A, Bertram C, Hafkemeyer U, Wissel J, et al. Treatment of adductor spasticity with BTX-A in children with CP: a randomized, double-blind, placebo-controlled study. Dev Med Child Neurol 2006; 48: 10−13.
25. Lowe K, Novak I, Cusick A. Repeat injection of botulinum toxin A is safe and effective for upper limb movement and function in children with cerebral palsy. Dev Med Child Neurol 2007; 49: 823−829.
26. Sätilä H, Pietikäinen T, Iisalo T, Lehtonen-Räty P, Salo M, Haataja R, et al. Botulinum toxin type A injections into the calf muscles for treatment of spastic equinus in cerebral palsy: a randomized trial comparing single and multiple injection sites. Am J Phys Med Rehabil 2008; 87: 386−394.
27. Joyce BM, Rockwood KJ, Mate-Kole CC. Use of goal attainment scaling in brain injury in a rehabilitation hospital. Am J Phys Med Rehabil 1994; 73: 10−14.
28. Tennant A. Goal attainment scaling: current methodological challenges. Disabil Rehabil 2007; 29: 1583−1585.
29. Malec JF, Smigielski JS, De Pompolo RW. Goal attainment scaling and outcome measurement in postacute brain injury rehabilitation. Arch Phys Med Rehabil 1991; 72: 138−143.
30. Bouwens SF, van Heugten CM, Verhey FR. The practical use of goal attainment scaling for people with acquired brain injury who receive cognitive rehabilitation. Clin Rehabil 2009; 23: 310−320.
31. Prigatano GP, Wong JL. Cognitive and affective improvement in brain dysfunctional patients who achieve inpatient rehabilitation goals. Arch Phys Med Rehabil 1999; 80: 77−84.
32. Cusick A, McIntyre S, Novak I, Lannin N, Lowe K. A comparison of goal attainment scaling and the Canadian Occupational Performance Measure for paediatric rehabilitation research. Pediatr Rehabil 2006; 9: 149−157.
33. Bode RK, Rychlik K, Heinemann AW, Lovell L, Modla L. Reconceptualizing poststroke activity level using the Frenchay Activities Index. Top Stroke Rehabil 2003; 9: 82−91.
34. Jelles F, van Bennekom CAM, Lankhorst GJ, Sibbel CJP, Bouter LM. Inter- and intra-rater agreement of the Rehabilitation Activities Profile. J Clin Epidemiol 1995; 48: 407−416.
35. Law M, Polatajko H, Pollock N, McColl MA, Carswell A, Baptiste S. Pilot testing of the Canadian Occupational Performance Measure: clinical and measurement issues. Can J Occup Ther 1994; 61: 191−197.
36. Cup EH, Scholte op Reimer WJ, Thijssen MC, van Kuyk-Minis MA. Reliability and validity of the Canadian Occupational Performance Measure in stroke patients. Clin Rehabil 2003; 17: 402−409.
37. Geyh S, Cieza A, Schouten J, Dickson H, Frommelt P, Omar Z, et al. ICF Core Sets for stroke. J Rehabil Med 2004; 44 Suppl: 135−141.
38. Bakheit AM, Pittock S, Moore AP, Wurker M, Otto S, Erbguth F, et al. A randomized, double-blind, placebo-controlled study of the efficacy and safety of botulinum toxin type A in upper limb spasticity in patients with stroke. Eur J Neurol 2001; 8: 559−565.
39. Duff J, Evans MJ, Kennedy P. Goal planning: a retrospective audit of rehabilitation process and outcome. Clin Rehabil 2004; 18: 275−286.
40. Turner-Stokes L, Williams H. Goal attainment scaling: a direct comparison of alternative rating methods. Clin Rehabil 2010; 24: 66−73.