

## Goal Attainment Scaling Made Easy With an App: GOALed

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Pediatric physical therapists use Goal Attainment Scaling (GAS) in a variety of clinical settings to objectively measure change in individual-, patient- and family-centered goals. Creating, recording, storing, scoring, and interpreting GAS goals have been manually completed. Recently developed GOALed, a GAS app, provides an improved, streamlined approach. The purpose of this special communication is to introduce the GOALed app and demonstrate its use with a case example. (Pediatr Phys Ther 2019;31:225–230)

**Key words:** GAS, goal attainment scaling, GOALed, goals, outcome measure

### INTRODUCTION

Goal Attainment Scaling (GAS) is increasingly being used in a variety of settings<sup>1-4</sup> including pediatric physical therapy. It provides a patient- and family-centered approach that addresses functional tasks. Because of this approach, patients or families may find GAS information more relevant than information from standard outcome measures.<sup>2,6</sup> GAS measures change in individual goals and generates a summary for an individual's multiple goals. These can be compared among individuals. Program effectiveness (eg, comparisons between different physical therapy clinics, hospitals, or physical therapists) can also be captured with GAS.<sup>6</sup> A GAS is typically created, recorded, stored, and scored manually. A scaling table, mathematical calculations, and a T-score conversion table are necessary to complete a GAS. This manual approach to GAS is labor intensive,<sup>6</sup> which may interfere with clinical implementation. The purpose of this article is to introduce and demonstrate the recently developed GOALed app that allows therapists to create, record, store, score, and interpret GAS on a smartphone or tablet in a user-friendly and consolidated manner.

### BACKGROUND AND GAS REVIEW

Capturing specific behavioral improvement in individuals with mental health conditions was historically ambiguous. Kiresuk et al<sup>6</sup> developed GAS to provide a more objective means. Education, corrections, chaplain training, substance abuse, medicine, and rehabilitation began using GAS.<sup>6</sup> In pediatric physical therapy, GAS is an appealing approach because it supports individual and objective measurement of behavioral, sensory, and/or motor skills in children with disabilities.<sup>1</sup> Effective use of GAS has been documented for a clinic for children with spasticity,<sup>2</sup> children with sensory modulation impairments,<sup>1,3</sup> and school-based gross motor outcomes.<sup>4</sup>

Following GAS training to support the development of reliable and valid goals,<sup>5-7</sup> the initial step in the GAS process relies on patient- and family-centered interviewing, to create meaningful functional and participatory goals. Collaboration among an interprofessional team to create realistic, yet rigorous, goals is recommended to further enhance reliability and validity of GAS.<sup>2,6</sup> Results from standardized and performance rehabilitation measures guide development of GAS goals.

Goals created with GAS follow “SMART” criteria: specific, measurable, attainable, relevant, and realistic within a time limit.<sup>2,8</sup> Goals should specifically address the “who,” “what,” “when,” “why,” and “where” to promote the individual quality of the GAS. Creating goals using the International Classification of Functioning, Disability and Health (ICF) (eg, impairments, activities, participation, and environmental factors) is recommended<sup>9</sup> and promotes GAS specificity. To be considered measurable, criteria for monitoring progress should have 1 variable that demonstrates equal, clinically meaningful intervals across the 5 ICF levels. These individualized goals should be attainable yet set with expectations. Attainability may best be inferred by pediatric therapists because of developmental and rehabilitation expertise; however, suggestions by family members and children with disabilities highlight goal relevance. Goals written within the contextual factors of the child's life

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At the time this article was initially written, Erin Gaffney was a student at the Medical University of South Carolina and an accepted resident at TIRR Memorial Hermann and Kevin Gaffney was a student at the University of Oklahoma. Erin Gaffney is currently an employee of TIRR Memorial Hermann.

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**TABLE 1**  
Defining GAS Values

Value	Scale A <sup>3</sup>	Scale B <sup>1</sup>
Indication	Progressive health disorder	
-2	Regression from current level of performance	Current level of performance
-1	Current level of performance	Progress toward expected level of performance
0	Expected level of performance	Expected level of performance
+1	Greater than expected level of performance	Greater than expected level of performance
+2	Much greater than expected level of performance	Much greater than expected level of performance

Abbreviation: GAS, Goal Attainment Scaling.

support child- and family-centeredness that strengthens goal relevance and promotes a realistic opportunity for attainment. Time for achievement should be provided.

The GAS assumes a normal distribution with the probability that a certain level of performance occurs for an individual child. Levels of performance that a child is expected to achieve are assigned values equally spaced between -2 and 2. Levels are based on interviewing, standardized assessments, and therapists'/interprofessional team's knowledge and should address 1 specific variable, such as repetitions, duration, frequency, distance, or assistance level (Table 1).

Several options are available for defining the GAS values of -2 and -1.<sup>1,6,10</sup> For example, -2 may be defined as "current level of performance" or "regression of performance"; -1 is defined as "progress toward expected outcome" or "current level of performance." When -2 is assigned as "regression of performance," this is reflective of a decline or regression of the health condition or disability (Table 1). This is typically used when a child has a degenerative condition and/or regression in the health condition or disability needs to be closely monitored. Defining a -2 value as "current level of performance" is the more common GAS method and is typically used with children

having more chronic, nonprogressive health conditions and/or disability (Table 1). Regardless of how -2 and -1 are defined, values between 0 and 2 capture increments of progression. The 0, 1, and 2 values are defined as expected level of performance, greater than expected level of performance, and much greater expected level of performance.<sup>6</sup> If organizations plan to compare children's GAS goals across teams, settings, or locations (ie, program effectiveness), a consistent definition should be used when assigning the value of -2 or -1 to the GAS.

Other GAS methods exist. Turner-Stokes<sup>11</sup> suggests using 2 levels, initial and expected, and defines additional levels made after progress has been assessed. Krasny-Pacini and colleagues<sup>2</sup> proposed the use of a 3-point scale (ie, -2, 0, +2) with a suggestion of applying rank testing rather than T-score calculation. These suggestions are based on the view that GAS is ordinal rather than interval scaled and, therefore, should use nonparametric statistical testing.<sup>2,12,13</sup> Steenbeek and colleagues<sup>13</sup> also oppose the use of T-scores and propose the use of a 6-point scale in which -2 represents current level of performance and -3 indicates regression. In a botulinum toxin pediatric intervention study, Cusick and associates<sup>14</sup> introduced a 7-point Likert scale GAS to address floor and ceiling effects.

**TABLE 2**  
Specific 6-Month GAS Goals for the Case Example of Violet

	Gross Motor 1	Gross Motor 2	Fine Motor 1	Fine Motor 2
	Within 10 min in an open, safe school or community environment and with supervision while using power wheelchair with head array (head control), Violet will successfully drive to and knock down:	Over a 10-min duration, in a school or clinical setting, using a Motomed cycle with built-in monitoring, Violet positioned in adaptive seating will initiate <i>active</i> lower extremity muscle contraction for cycling for:	To improve upper extremity strength for operating a television remote control in her home and while positioned in her manual wheelchair with tray, Violet will grasp and lift a 2-lb remote control:	To manage saliva from mouth across all settings and while positioned in her manual wheelchair, Violet will grasp washcloth and place to mouth for wiping with:
-2: Current level of performance	0 obstacle	0 s	0 in	Total assistance (100%-76%)
-1: Progress toward outcome	1 obstacle	30 s	3 in	Maximum assistance (75%-51%)
0: Expected level	2 obstacles	60 s	6 in	Moderate assistance (50%-26%)
+1: Greater than expected outcome	3 obstacles	90 s	9 in	Minimal assistance (25%-1%)
+2: Much greater than expected outcome	4 obstacles	120 s	12 in	Independence

Abbreviation: GAS, Goal Attainment Scaling.

When assessing and scoring a GAS, the raw score (ie, -2 to +2) can be assigned and converted into a T-score, which is a standardized statistic that allows within or between subject comparisons. T-scores are used for small sample sizes ( $n < 30$ ) with unknown population standard deviations, which is reflective of the individuality of GAS.<sup>15</sup> Prior to the recent development of the GOALed app, the conversion of a GAS raw value to a T-score was done manually using 1 of 2 methods:

(1) Equation calculation

a. For T-score:

$$T = 50 + \frac{10 \sum w_i x_i}{\sqrt{(1-p) \sum w_i^2 + p(\sum w_i)^2}}$$

where  $\Sigma$  is sum;  $w$  is weighted value of goal;  $x$  is score;  $p$  is expected correlation between goals (0.3 recommended)<sup>6</sup>;  $\mu$  is mean, and  $\sigma$  is standard deviation.

(2) Conversion key tables for 1 to 8 scalings in *Goal Attainment Scaling: Applications, Theory, and Measurement* by Kiresuk et al.<sup>6</sup>

## GOALed APP

Because electronic smart devices are available, the manual completion of scaling can be completed with an electronic application. Based on the GAS method created by Kiresuk and colleagues,<sup>6</sup> the GOALed app was developed to simplify the creating, recording, storing, scoring, and interpreting GAS goals. The GOALed app provides a concise single results page that displays the summed raw score, T-score, bar graph, and bell-shaped curve for 1 or multiple GAS goals. This results that page may promote clearer GAS interpretation not only for clinicians, but also for patients and caregivers when findings are shared.

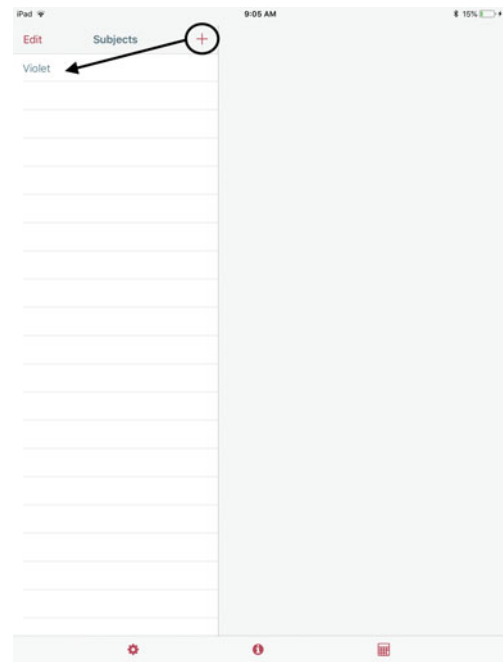


Fig. 1. Adding name.

## Case Demonstration Using the GOALed App

Findings from standardized and performance rehabilitation measures should always guide the development of GAS goals. For children with medical complexity, who are challenging to measure using standard assessments, the individual and objective measurement of GAS better captures change in performance and informs future goal writing.<sup>1,6</sup> The below case of a child with medical complexity applies the GOALed app.

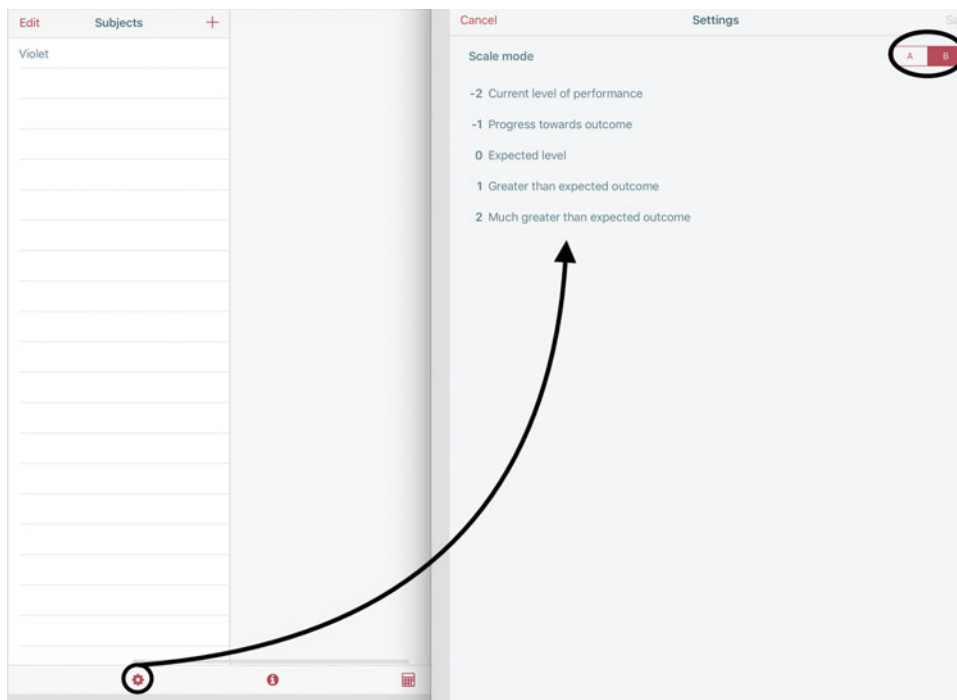


Fig. 2. Selecting scale mode on Settings page.

## Brief Description

Violet is a 16-year-old girl with a diagnosis of mitochondrial myopathy. She had multiple hospitalizations for surgery (eg, spinal fusion, femoral osteotomy, gastrostomy tube placement, and idiopathic fractures) and has a variety of comorbidities (eg, osteoporosis, aspiration, and seizures). She is dependent for transfers, mobility, self-care, and communication. Participatory activities include public school and church attendance. Important contextual factors that facilitate Violet's participation are assistive technology, environmental wheelchair accessibility, and knowledgeable, interprofessional providers and caregivers. Barriers to participation include Violet's dependence on assistance, lack of wheelchair transportation, and age and physical capacity of the grandmother serving as the primary caregiver. Following the family-centered interviewing process and standardized assessment completion (eg, Pediatric Evaluation of Disability Inventory, Developmental Assessment for Students with Severe Disabilities, Cortical Visual Impairment evaluation, and Caregiver Priorities and Child Health Index of Life with Disabilities), the grandmother and interprofessional rehabilitation team identified and prioritized goal areas that address (1) power

mobility for exploration in controlled school and community environments, (2) lower extremity muscle activation for active cycling in school and community settings, (3) ability to operate a television remote control at home, and (4) self-wiping of mouth to remove excessive saliva in all settings. Specific GAS goals are in Table 2.

## GOALed Demonstration Using Violet's Goals

*Step 1: Downloading the GOALed app.* Violet's pediatric physical therapist (PT) downloaded the free GOALed app from the Apple App Store (also available from Google Play) to her iPhone and iPad.

*Step 2: Selecting the scale mode: regression or current level of performance.* Violet's pediatric PT opened the app and created her subject profile by tapping the "+" and typing her name (Figure 1). De-identified profiles can be created using numeric identification. The pediatric PT then chose Scale B (Figure 2) that defines the -2 value as current level of performance because Violet's diagnostic health condition has been chronic rather than progressive.

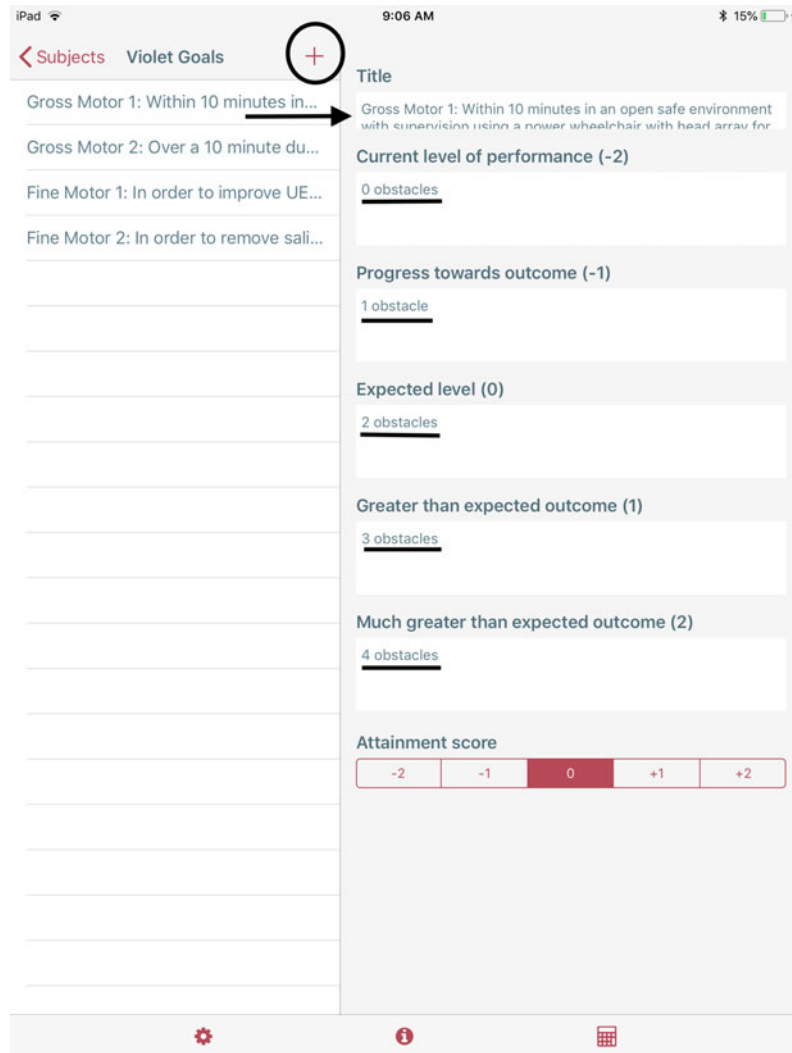


Fig. 3. Adding goals.

**Step 3: Writing goals.** Violet's pediatric PT created and stored her goals to her subject profile by tapping the "+" for each individual GAS. She can add (ie, tapping "+") or delete (ie, swipe left) a GAS for Violet from the GOALed app at any time. The pediatric PT gave each goal a title, which included the entire goal narrative, but she could have used a summarized version. The pediatric PT then assigned and recorded the levels of attainment levels for each goal (Figure 3).

**Step 4: Scoring and calculating goals.** At the end of 4 weeks of physical and occupational therapy, Violet had made the following progress:

Gross motor 1 goal: Within 10 minutes in an open, safe school or community environment and with supervision while using a power wheelchair with head array, Violet successfully drove to and knocked down 2 obstacles. (Score of 0, "expected level of performance" on GAS.)

Gross motor 2 goal: Over a 10-minute duration, in a school or clinical setting, using a Motomed cycle with built-in monitoring, Violet positioned in adaptive seating initiated active bilateral lower extremity muscle contraction during cycling for 120 seconds. (Score of 2, "much greater than expected level of performance" on GAS.)

Fine motor 1 goal: To improve upper extremity strength for operating a television remote control in her home and while positioned in her manual wheelchair with tray, Violet grasped and lifted a 2-lb remote control 0 inch. (Score of -2, "current level of performance" on GAS.)

Fine motor 2 goal: To remove saliva from mouth across settings and while positioned in her manual wheelchair, Violet

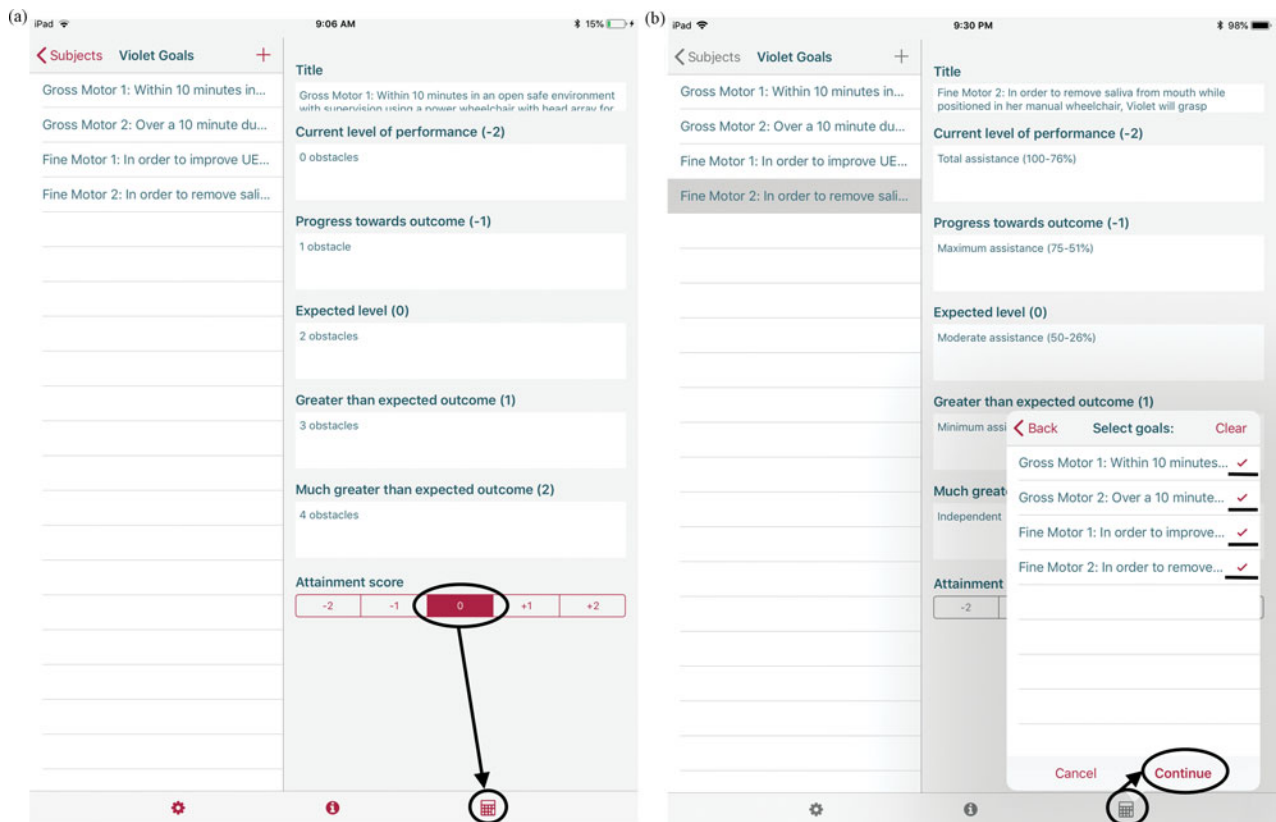
grasped and placed a washcloth to mouth for wiping with minimum assistance (Score of 1, "greater than expected level of performance" on GAS.)

For each of these goals, the pediatric PT tapped the appropriate raw score value between -2 and 2 (Figure 4a). To calculate cumulative raw and T-scores, the pediatric PT (1) tapped the calculator icon in the right lower hand corner, (2) selected Violet, and (3) then selected Violet's goals to be calculated into T-scores. She calculated the T-score for goal 1 (Figure 4a) and collectively for 4 goals (Figure 4b). Violet's pediatric PT then saw a results page displaying the date, identification number, raw score, T-score, bar graph, bell curve, and succinct narrative interpretation of Violet's goal 1 and collective goals 1 through 4 (Figure 5).

**Step 5: Interpreting results.** Using the results information, Violet's pediatric PT was able to easily interpret her GAS goals (eg, greater than expected outcome and expected outcome) and then shared the results with the patient and families in person, through e-mail and text messaging (Figure 5). She was also able to export the raw GAS values into a Microsoft Excel file, which was used for documentation.

## CONCLUSION

The GOALed app allows pediatric PTs to create, record, store, score, and interpret GAS goals on their smartphones or tablets. Because of the potential of GAS to objectively measure change in individual-, patient- and family-centered rehabilitation goals, it is increasingly used in a variety of settings<sup>1-4</sup> within



**Fig. 4.** Scoring and calculating goals.



Fig. 5. Results screen.

pediatric physical therapy. The streamlining of the GAS process using the GOALed app may be more inviting to pediatric PTs and better support its clinical implementation within pediatric physical therapy practice.

## REFERENCES

1. Mailloux Z, May-Benson TA, Summers CA, et al. Goal attainment scaling as a measure of meaningful outcomes for children with sensory integration disorders. *Am J Occup Ther.* 2007;61(2):254-259.
2. Krasny-Pacini A, Pauly F, Hiebel J, Godon S, Isner-Horobeti ME, Chevignard M. Feasibility of a shorter Goal Attainment Scaling method for a pediatric spasticity clinic—the 3-milestones GAS. *Ann Phys Rehabil Med.* 2017;60(4):249-257.
3. Miller LJ, Schoen SA, James K, Schaaf RC. Lessons learned: a pilot study on occupational therapy effectiveness for children with sensory modulation disorder. *Am J Occup Ther.* 2007;61(2):161-169.
4. Chiarello LA, Effgen SK, Jeffries L, McCoy SW, Bush H. Student outcomes of school-based physical therapy as measured by Goal Attainment Scaling. *Pediatr Phys Ther.* 2016;28(3):277-284.
5. Cytrynbaum S, Ginath Y, Birdwell J, Brandt L. Goal attainment scaling: a critical review. *Eval Q.* 1979;3:5-40.
6. Kiresuk TJ, Smith A, Cardillo JE. *Goal Attainment Scaling: Applications, Theory, and Measurement.* New York, NY: Lawrence Erlbaum Associates; 1994.
7. McDougall J, King G. Goal attainment scaling: description, utility, and applications in pediatric therapy services. [http://elearning.canchild.ca/dcd\\_pt\\_workshop/assets/planning-interventions-goals/goal-attainment-scaling.pdf](http://elearning.canchild.ca/dcd_pt_workshop/assets/planning-interventions-goals/goal-attainment-scaling.pdf). Published 2007. Accessed April 16, 2018.
8. Doran GT. There's a S.M.A.R.T way to write management's goals and objectives. *Manag Rev.* 1981;70(11):35-36.
9. World Health Organization. Classification of Functioning, Disability and Health. <http://www.who.int/classifications/icf/en/>. Published 2001.
10. King GA, McDougall J, Palisano RJ, Gritzan J, Tucker MA. Goal attainment scaling: its use in evaluating pediatric therapy programs. *Phys Occup Ther Pediatr.* 1999;19(2):31-52.
11. Turner-Stokes L. Goal attainment scaling (GAS) in rehabilitation: a practical guide. *Clin Rehabil.* 2008;23:362-370.
12. McacKay G, Somerville W, Lundie J. Reflections on goal attainment scaling (GAS): cautionary notes and proposals for development. *Educ Res.* 1996;38(2):161-172.
13. Steenbeek D, Ketelaar M, Lindeman E, Galama K, Gorter JW. Interrater reliability of goal attainment scaling in rehabilitation of children with cerebral palsy. *Arch Phys Med Rehabil.* 2010;91(3):429-435.
14. 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(2):149-157.
15. Portney LG, Watkins MP. *Foundations of Clinical Research Applications to Practice.* 2nd ed. Upper Saddle River, NJ: Prentice Hall Health Inc; 2000.