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REVIEW

Goal attainment scaling for patients with low back pain in rehabilitation: A systematic review

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Abstract

Background and aims: Goal attainment scaling (GAS) has been widely applied to chronic conditions; however, only recently has it been used for patients with low back pain (LBP). The objectives of this systematic review were to (a) examine the characteristics and rigor of published studies of GAS in the rehabilitation of patients with LBP, (b) describe how GAS has been applied in patients with LBP, and (c) evaluate the responsiveness and validity of GAS as an outcome measure in patients with LBP.

Methods: A systematic search of the CINAHL, PubMed, and MEDLINE databases was performed (1968 and 1 September 2020) in addition to hand searching. Studies including GAS procedures in patients with LBP during rehabilitation were included in the review. Two authors independently selected studies for inclusion and determined levels of evidence using the Oxford Levels of Evidence and rated each study for quality using the Newcastle-Ottawa scale and reporting transparency using the STROBE statement checklist.

Results: Six Level IV and one Level III/IV study were included in this review (search produced 248 studies for review). These studies assessed GAS feasibility, validity, sensitivity, and association with other outcome measures in patients with LBP. Findings suggest that patients with LBP are able to identify and set individualized goals during GAS, while GAS may be more sensitive to change and may measure different aspects of the patient experience as compared with fixed-item patient-reported measures. Additionally, GAS may have a therapeutic effect while improving patient outcomes and may be associated with patient satisfaction.

Conclusion: Based on this review, GAS shows promise as a feasible patient-centered measure that may be more responsive to change than traditional outcome measures. However, GAS has been inadequately developed and validated for use during rehabilitation in patients with LBP.

KEYWORDS
health services research, patient-centered care, systematic review

1 | INTRODUCTION

Low back pain (LBP) is the second most common cause of disability in the general population, is the most common cause of activity limitation and disability in people under the age of 45 in the United States, and is globally the leading cause of years lived with disability.[1–5] Direct and indirect costs due to LBP continue to rise and are estimated to approach 626 billion dollars annually in the United States,[6,7] and estimates from Europe indicate up to 2% of gross domestic product.[8,9] In 2015, 3.67 million people between 18 and 64 years of age indicated they were unable to work due to chronic back or neck pain, while an additional 1.75 million indicated that their work was limited due to chronic back or neck pain.[10] Physical therapists are commonly involved in the management of patients with LBP[11–13]; however, it has been suggested that the use of standardized outcome measures may be time-consuming, confusing, and difficult for patients to complete.[14] The present healthcare environment emphasizes patient-centered outcomes[15]; however, current measures used for patients with LBP often fail to incorporate patient-centeredness.[16] Patient-centered outcomes address the needs of healthcare providers and researchers for measures to accurately assess the effectiveness of interventions for patients with LBP.

Numerous standardized outcomes exist for healthcare providers to measure changes in patients with LBP, including the use of measures of pain and disability, such as the numerical rating scale and Oswestry disability index.[17–19] While these measures are typically considered the current standard for research and clinical practice,[18] the isolated use of such measures to guide clinical decision-making and the meaningfulness of these measures to patients remains unclear.[20] These measures provide important information regarding the interpretation of populations in group studies; however, their usefulness in making decisions about individual patients is often limited.[21,22] Patients with LBP define improvement based on their capacity to reengage in activities and return to participation that is important to them as individuals.[23] Standardized fixed-item patient-reported outcome measures alone may not fully reflect the scope of a patient's impairments, activity limitations, and participation restrictions because these measures often disregard the needs of each individual patient. Froud et al suggest that researchers develop outcome measures that address social factors (eg, the impact of LBP on relationships and worry about work).[24] Failure to capture and relate progress to the unique experience of individuals with LBP may explain the low to modest treatment effects reported for most intervention studies for chronic LBP, even when findings are aggregated in systematic reviews.[25–33]

Several researchers have suggested that outcome measures where each patient can identify his/her particular treatment goal(s), such as is done in goal attainment scaling (GAS) (Figure 1), may better reflect goals that are important for individual treatment success.[22,34,35] GAS was developed by Kiresuk and Sherman[35] to evaluate individual and group outcomes in mental health services. The theory supporting the GAS procedure questions the assumption that a universally acceptable outcome measure exists due to the variety of goals that are meaningful to individual patients.

The stages of the GAS process[22] are illustrated in Figure 1. In the first stage, three to five goals are identified during the patient interview to establish an agreed upon set of priority goals following the SMART principle[36] (specific, measurable, achievable, realistic/relevant, and time-based). These goals are weighted for importance and difficulty using a 4-point scale (Table 1). The weight for each goal is then calculated (weight = importance × difficulty). The clinician and patient define the expected outcome, for each goal. The scores are then converted to a GAS T-score, which provides a numerical value for the degree to which patient-initiated goals have been achieved.[22,35] A GAS T-score of 50 means that the expected outcome was achieved, while a score less than 50 indicates performance below the expected outcome and a score greater than 50 indicates performance exceeding the expected outcome.[37] This process allows for the

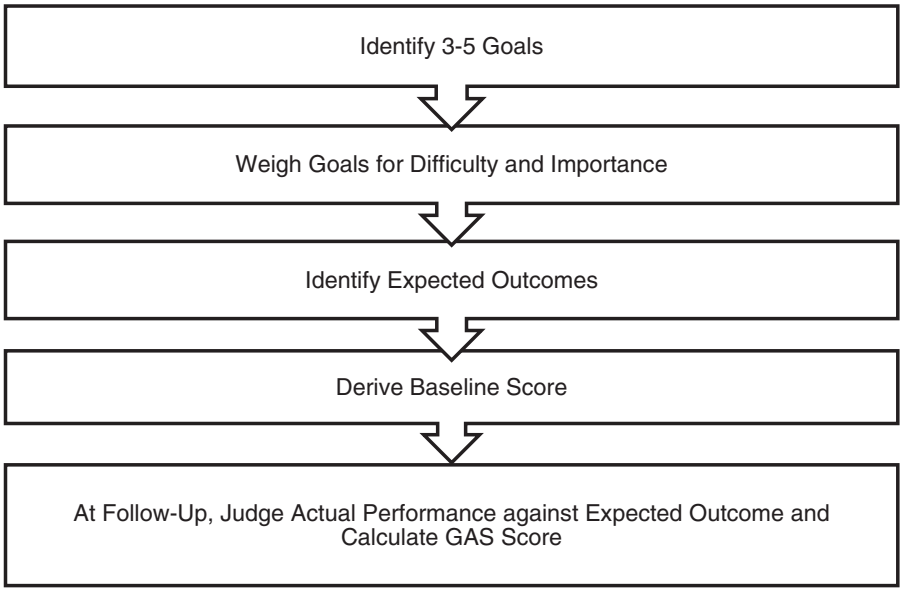

FIGURE 1 Goal attainment scaling stages

TABLE 1 Weighting scale for importance and difficulty as described by Turner-Stokes[22]

Importance	Difficulty
0 = not at all	0 = not at all
1 = a little	1 = a little
2 = moderately	2 = moderately
3 = very	3 = very

identification of a patient-generated (thus patient-centered) outcome measure that can be used to monitor changes over time in individual patients.

Healthcare providers routinely apply goal setting in clinical practice; however, GAS differs in that the goals are both quantified and patient-initiated, rather than entirely qualitative and provider-nominated.[21,38] Furthermore, care focusing on an individual's goals, such as GAS, may facilitate patient-centered care. GAS has the potential to increase provider and patient focus on preferred activities and aid in collaboration to achieve an individual's goals.[39] GAS may be particularly applicable in heterogeneous patient populations with complex presentations encompassing varied emotional, physical, and social domains.[34] Therefore, GAS may be an ideal outcome measure for healthcare providers to use in the management of patients with chronic LBP. GAS has been widely applied to chronic and disabling conditions[34,40]; however, only recently has it been used to address the problems associated with chronic LBP.[21,37,41–45] Therefore, the objectives of this systematic review were to (a) examine the characteristics and rigor of published studies of GAS in the rehabilitation of patients with LBP, (b) describe how GAS has been applied in patients with LBP, and (c) evaluate the responsiveness and validity of GAS as an outcome measure in patients with LBP.

2 | METHODS

2.1 | Protocol and registration

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[46] This study had no prepublished or registered protocol before commencement.

2.2 | Data sources and searches

A systematic search of the literature was performed by a single investigator (DDH) using CINAHL, PubMed (Legacy), and MEDLINE databases between the years 1968 and 1 September 2020. We limited the results to those in the English language using human participants. The following keywords were combined to perform the search: ("goal attainment scal*" OR "goal attainment procedur*" OR "goal scal*" OR "goal attainment scor*" OR "goal achievement") AND ("low back pain" OR "lumbago" OR "spinal disorders"). Additional hand searching was completed by scanning the reference lists of included articles.

2.3 | Study selection

The following inclusion criteria were used to select relevant articles from the search results: (a) GAS as the primary intervention and/or outcome; (b) was applied to a patient population with LBP; and (c) receiving rehabilitation by physical therapists either alone or as part of a multidisciplinary rehabilitation team. Articles were excluded if (a) the article was an opinion paper, editorial, or non-peer reviewed, (b) GAS was not an outcome or treatment, (c) the article was not written in English, or (d) LBP was not a primary diagnosis. Study screening for eligibility was completed independently by two investigators (DEH and DDH) who first screened all articles by title and abstract and then finally through a review of the remaining full-text articles. All discrepancies were resolved by consensus.

2.4 | Data extraction and quality assessment

Two investigators (DEH and DDH) independently extracted the relevant data from the articles using a standardized data table that included the first author's last name, country of origin, year published, setting of the study, participant demographics (sample size, sex, age, primary diagnoses), study design, study purpose, outcome measures used, study results, and study conclusion. Any discrepancies were discussed until consensus was reached.

Two independent raters (DEH and DDH) independently determined the levels of evidence of each article using the Oxford Levels of Evidence[47] and rated each of the included articles for quality using the Newcastle-Ottawa scale for cohort studies (NOS)[48] and for reporting transparency using the STROBE statement checklist.[49] The NOS is a 0- to 10-point scale used to assess the quality of cohort studies with higher scores indicating higher quality.[48] The NOS shows generally fair intra-rater reliability and excellent test-rest reliability.[50] The STROBE statement checklist is a 22-item binary (yes or no) checklist that provides guidance for reporting observational studies.[49] This tool was chosen as a supplement for NOS to describe the reporting quality[51] or the comprehensiveness and clarity of reporting of the studies. Any discrepancies in scoring were discussed until consensus was reached.

2.5 | Data synthesis and analysis

Data from the included studies were synthesized narratively as quantitative analysis was not appropriate given the variability in the included studies. The aim of the narrative synthesis was to summarize the study characteristics and the application of GAS procedures and their use in measuring patient outcomes in patients with LBP. To analyze the agreement between raters (DEH and DDH), percent

agreement was calculated for each individual criterion on the STROBE statement checklist. This was performed since reliability data on the use of the STROBE checklist for assessing reporting quality for cohort studies have not been established.

3 | RESULTS

The initial query of CINAHL, PubMed, and MEDLINE produced 247 articles, and an additional 1 article was identified through hand searching. After duplicates were removed, 221 articles were screened for eligibility. Screening titles and abstracts removed 213 articles, and full-text review removed an additional 1 article. Therefore, seven articles met the eligibility requirements for inclusion in this review (Figure 2).

3.1 | Description of studies

Table 2 summarizes extracted data from the included articles. Identified studies were predominantly observational cohort studies that investigated the feasibility of GAS in clinical practice,[41,44] its validity and sensitivity,[37,45,52] and associations with measures of patient satisfaction[21,42] and standard outcome measures[21,41–44] in patients with LBP. All studies investigated GAS as an outcome measure, while one study[45] also considered GAS as an intervention. Physiotherapists[37,44] applied GAS in two of the seven included studies, while four studies indicated that GAS was applied by an unspecified provider[42,45] or "therapist,"[41,52] and one was completed by an occupational therapist.[21] Those studies that did not specify the provider were composed of multidisciplinary teams that include physical therapy, occupational therapy, and/or psychology; therefore, the term "therapist" may be used to describe any of these providers.

These studies have several limitations, including the use of observational cohorts with no comparison group, deviations from standard GAS procedures, and lack of description of formal training for clinicians. One study[45] examined the therapeutic efficacy of GAS and showed improvements in GAS scores following intervention. However, the study was performed in patients (72.4% who had LBP) with poorly defined chronic pain (eg, missing cause or duration of pain). In addition, the majority of studies using GAS were completed in research settings outside the United States.[37,41,43,44,52]

3.2 | Main findings of studies

Two studies found that patients are able to identify and set individualized goals during GAS.[43,44] Two studies[37,41] found that GAS may be more sensitive to change than fixed-item patient-reported measures

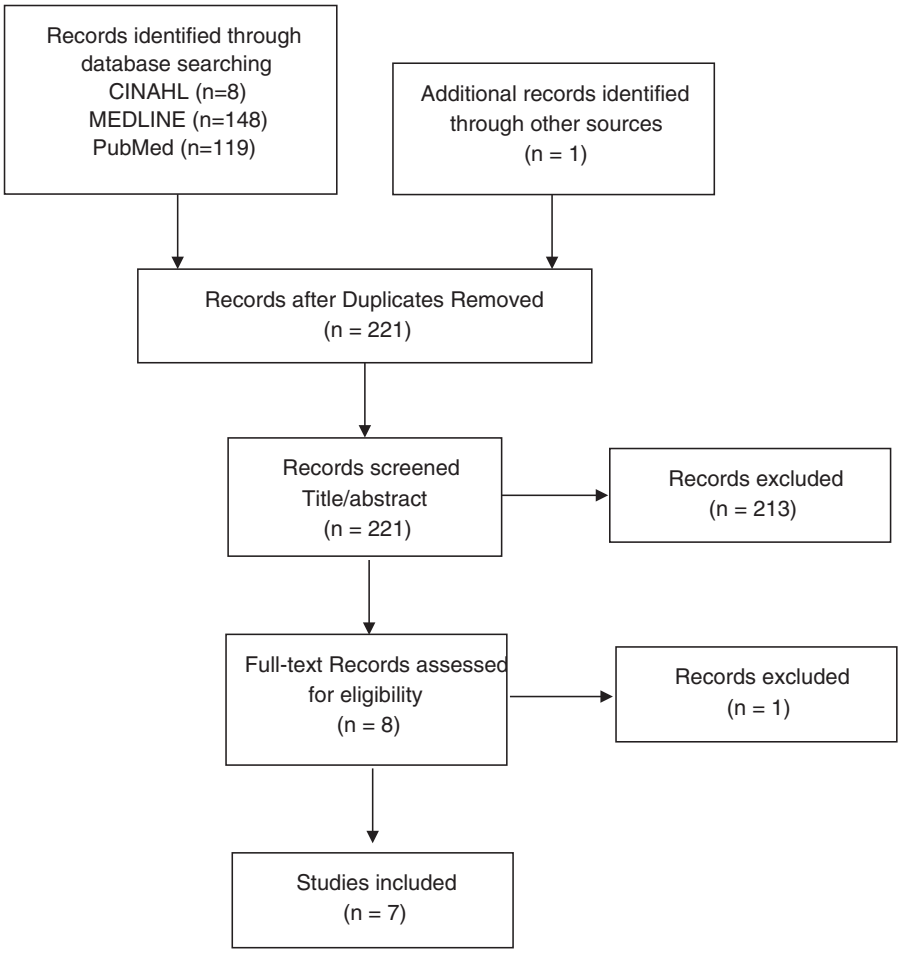

FIGURE 2 Study flow of records

TABLE 2 Evidence table

Author, Year, Country	Setting	Sample	Design	Level of evidence	Newcastle-Ottawa score	Properties investigated	Outcome measures employed
Fisher and Hardie, 2002, England	15-d pain management program (day and residential) in a regional rehabilitation center	112 subjects (32% male; age 43 y) with back pain lasting at least 1 y	Observational cohort	IV	6	Feasibility in a chronic pain setting	Goal attainment scaling Timed tests of physical mobility measures McGill pain questionnaire Pain—Numerical rating scale Oswestry LBP disability questionnaire (ODQ) General health questionnaire Pain and impairment relationship scale
Hazard et al., 2009, USA	Multi-disciplinary rehabilitation program	89* subjects (51%male; age 42 ± 9 y) with chronic disabling back and/or neck pain *1 y follow-up data are for 86 participants	Observational cohort	IV	5	Relation between goal achievement and patient satisfaction	Pain magnitude Physical function subscale of SF-36 Patient satisfaction Functional goal achievement
Hazard et al., 2012, USA	Multi-disciplinary rehabilitation program	62 patients (52% male; age 44 ± 10 y) with chronic disabling back and/or neck pain	Observational cohort	IV	6	Relation between goal achievement and patient satisfaction	Functional goal achievement Pain goal achievement Pain magnitude Physical function (PF-10) Patient satisfaction
Mannion et al., 2010, Switzerland	Outpatient physiotherapy department	32 subjects (34% male; age 44 ± 12 y) with chronic LBP (92 ± 129 mo)	Observational cohort	IV	5	Measurement of Treatment Success	Goal attainment Scale (GAS) Roland-Morris disability scale (RM) Pain graphic rating scale
Mullis et al., 2011, England	Multidisciplinary clinic	35 patients with (26% male; age 50 ± 14 y) with un-resolving acute low back pain	Observational cohort	IV	4	Association between goal attainment scores and disability, general health, and global change	Modified goal attainment scale (mGAS) Pain rating Roland-Morris disability questionnaire (RMDQ) Satisfaction General health status
Oliver et al., 2017, England	15-day pain management program (day and residential) in a regional rehabilitation center	162 participants (29% male, mean 47.7 y) completed follow-up 45 LBP 19 Neck pain 98 More than 1 site of pain.	Observational cohort	IV	6	Prediction of GAS as an outcome by perceived pain, self-efficacy, emotional distress, and physical improvement.	Goal attainment scaling (GAS) Pain rating (NRS) Pain self-efficacy questionnaire (PSEQ) The hospital anxiety and depression scale (HADS) 5 min distance walked 1 min sit/stand 1 min stair climb

(Continues)

TABLE 2 (Continued)

Author, Year, Country	Setting	Sample	Design	Level of evidence	Newcastle-Ottawa score	Properties investigated	Outcome measures employed
Williams and Steig, 1986, USA	Free standing multidisciplinary outpatient pain center	Study 1:76 patients (49% male; age 42 y) treated at a chronic pain center (72.4% with pain in low back and legs) Study 2: Same as above plus control group (129 patients)	Study 1: Observational cohort Study 2: Retrospective case-control	Study 1: IV Study 2: III	Study 1:6 Study 2:8	Study 1: GAS construct validity Study 2: GAS as an assessment of treatment efficacy	Study 1 and 2: Ambulation distance (20 min) Uptime: self-report average number of hours patient upright position in 24 h Posture McGill pain questionnaire Pain—subjective pain rating Pain precipitating activities

Author, Year, Country	GAS approach/scale	Provider who applied GAS protocol	Major results	Conclusions
Fisher and Hardie, 2002, England	GAS as described by Kiresuk and Sherman[35]; 3-6 items/5 levels of attainment: baseline −1, expected outcome not described; weighting not described	Therapist	Moderate correlation between GAS and walking (0.47) and weak between GAS and ODQ (−0.29). Inter-correlation between GAS and ODQ explained approximately 10% of variance.	GAS change scores indicate that patients were able to attain individually valued goals. The change in GAS was greater than conventional measures. ODQ and GAS measure different aspects of the patient experience with chronic pain.
Hazard et al., 2009, USA	GAS as described by Kiresuk et al.[53] 3 goals- work, recreation, ADLs/7 levels of attainment: baseline 1, expected outcome not described; 7-point "importance scale"	Occupational Therapist	Average pain, physical function, and goal achievement score individually correlated with satisfaction (R2 = 0.28, 0.30, and 0.29, respectively). Combined the correlation was moderate (R2 = 0.43), in which the goal achievement score contributed the most (7.35%) to satisfaction.	Goal achievement may be a useful measure of patient outcome as it contributes more than pain and physical function to patient satisfaction.
Hazard et al., 2012, USA	GAS as described by Kiresuk et. al.[53] 3 goals- work, recreation, ADLs/7 levels of attainment: baseline 1, expected outcome not described; 7 point "importance scale"	Unspecified	Correlations between Patient Satisfaction and other measures ranged from 0.54-0.73) Functional Goal Achievement accounted for >2 times the variation in patient satisfaction.	Of the measures studied, functional goal achievement was most associated with patient satisfaction.
Mannion et al., 2010, Switzerland	GAS as described by Kiresuk and Sherman[35]; 2-5 goals/5 levels of attainment: Baseline −1, expected level 0; weighting not described	Physiotherapist	Moderate to strong correlations with RM (r = 0.49) and pain (r = 0.61), respectively. Percent with successful outcome: 65% according to GAS 55% according to Global Outcome 39% according to RM 44% according to pain scale	GAS was able to detect changes that were not detected by fixed-item measures, such as the RM (ie, GAS more sensitive).

TABLE 2 (Continued)

Author, Year, Country	GAS approach/scale	Provider who applied GAS protocol	Major results	Conclusions
Mullis et al., 2011, England	Modified GAS (GASmin) as described by: Mullis et al.[54] number of goals patient dependent (2, 3)/4 levels of attainment: Baseline 0, achievement of GASmin 1; weighting not described	Physiotherapist	mGAS was able to distinguish between those who improved and those who did not. These categories had a strong correlation (Kappa = 0.865) with disability ratings (RMDQ). In addition GAS had a strong correlation with satisfaction (Spearman's rho = 0.88) and moderate correlation with general health status (Sp. rho = 0.40)	mGAS may provide useful information regarding patient status and progress in patients with LBP seeking primary care.
Oliver et al., 2017, England	GAS as described by: Bovend'Eerdt et al[36]; 3-5 goals/5 levels of attainment: Baseline −1, expected outcome 0; weighting not described	Therapist	77% of participants achieved a GAS score of 50 or higher after 15 d. All variables except for HAD showed improvements at follow-up. Walking tolerance was a significant predictor of GAS score change. Self-efficacy made a significant additional contribution.	The use of patient-relevant outcomes with GAS showed significant achievement of personal goals at 6 months follow-up, following a CBT-based pain management program. Self-efficacy and walking tolerance were significant predictors for achieving personally important goals. Therefore, focus on enhancing self-efficacy and optimizing walking tolerance might be important in pain rehabilitation programs.
Williams and Steig, 1986, USA	GAS as described by Kiresuk and Sherman[35] – with "a few modifications"/5 levels of attainment: Baseline 0, expected response 1; weighting 5 level scale	Unspecified	Study 1: Weak correlation between change in GAS and posture scores (r = 0.21) Canonical factor analysis indicated that GAS, posture, and pain precipitating activities were related. Study 2: The addition of GAS accounted for 24.7% of the variance in improvement following intervention.	Study 1: GAS may be useful as an outcome measure for people with chronic pain. Study 2: The addition of GAS to other outcome measures may have a therapeutic effect.

TABLE 3 Critical appraisal of reporting transparency using STROBE checklist

STROBE checklist item	Fisher and Hardie[41]	Hazard et al[21]	Hazard et al[42]	Mannion et al[37]	Mullis et al[44]	Oliver et al[52]	Williams and Steig[45]	Percent agreement
1 (a.)	Y	Y	Y	N	Y	N	N	100
1 (b.)	Y	Y	Y	Y	Y	Y	Y	100
2	Y	Y	Y	Y	Y	Y	Y	86
3	N	Y	N	N	N	N	N	100
4	Y	Y	Y	Y	Y	Y	Y	86
5	Y	Y	Y	N	N	Y	Y	71
6 (a.)	Y	Y	Y	Y	Y	Y	N	86
6 (b.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	86
7	Y	Y	Y	Y	Y	Y	Y	100
8	Y	Y	Y	Y	Y	Y	Y	100
9	N	N	Y	N	N	N	N	86
10	Y	N	N	N	N	Y	Y	86
11	Y	Y	Y	Y	Y	Y	Y	86
12 (a.)	Y	Y	Y	Y	Y	Y	Y	71
12 (b.)	N	Y	Y	N	Y	Y	Y	57
12 (c.)	N	Y	Y	N/A	N/A	N/A	N/A	86
12 (d.)	Y	Y	Y	Y	N	N	Y	86
12 (e.)	N	Y	N	N	N	N	Y	71
13 (a.)	Y	Y	Y	Y	Y	Y	Y	86
13 (b.)	N	Y	Y	Y	N	Y	Y	100
13 (c.)	N	N	N	N	N	Y	N	71
14 (a.)	Y	Y	Y	Y	N	Y	Y	86
14 (b.)	N	Y	Y	Y	Y	Y	Y	100
14 (c.)	N/A	Y	N/A	Y	N/A	Y	Y	71
15	Y	Y	Y	Y	Y	Y	Y	71
16 (a.)	Y	Y	Y	Y	N	Y	N	57
16 (b.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	100
16 (c.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	100
17	N	N	N	N	N	N	Y	71
18	Y	Y	Y	Y	Y	Y	Y	100
19	N	N	N	Y	Y	Y	Y	71
20	Y	Y	Y	Y	Y	Y	Y	100
21	N	N	Y	Y	Y	N	Y	57
22	N	Y	Y	Y	Y	N	N/A	86

(Oswestry disability index and Roland-Morris disability questionnaire [RMDQ]). It is hypothesized that this sensitivity to change is due to GAS measuring different aspects of the patient experience in those with chronic LBP when compared with fixed-item patient-reported measures.[37,41,52] Specifically, it was found that the RMDQ accounted for only 78%[37] and 21%[43] of goals identified in GAS. Importantly, Mullis and Hay[43] found that GAS was able to discriminate those who improved and who did not improve and those that did not and GAS was moderately correlated with general health status ($r = 0.40$). GAS has been demonstrated to be associated with patient satisfaction (correlations ranged from $r = 0.29$-0.88).[21,42,43] Significantly, GAS was found to be more associated with patient satisfaction than pain and physical function outcome measures[21] and may account for up to two times the variance.[42] In addition, while GAS is generally considered an outcome measure, it may have a positive therapeutic effect and impact on outcomes as GAS accounted for 24.7% of the variance in improvement following intervention.[45]

3.3 | Levels of evidence and critical appraisal

Levels of evidence are included in Table 2. Six[21,37,41–44] of the seven studies were Level IV evidence, and a single article with two study parts[45] was both Level III (Study 1) and Level IV (Study 2). NOS scores

are included in Table 2 and ranged between 4 and 8, which represents medium to high risk of bias,[55] Specifically, a single study scoring an 8,[45] four studies scoring a 6,[41,42,45,52] to studies scoring a 5,[21,37] and a single study scoring a 4.[43] Reporting transparency data from the STROBE checklist are presented in Table 3. The greatest threats to reporting transparency were found in the following items: 3 "State specific objectives, including any prespecified hypotheses" (missing in six of seven studies), 9 "Describe any efforts to address potential sources of bias" (missing in six of seven studies), 13(c) "Participants: Consider use of a flow diagram" (missing in six of seven studies), 17 "Report other analyses done" (missing in six of 7 studies), 12(e) "Statistical methods: Describe any sensitivity analyses" (missing in five of seven studies), and 10 "Explain how study size was arrived at" (missing in four of seven studies). Overall, five of seven studies (71%) included 60% or more items on the STROBE checklist. Percent agreement between raters for individual criterion score ranged from 57 to 100%. Lower levels of agreement between reviewers were found for the following items: 12(b) describes any methods used to examine subgroups and interactions, 16(a) gives unadjusted estimates, and 21 discusses the generalizability (external validity) of the study results. This lower level of agreement was most likely due to the subjectivity of scoring for these items compared with other items in the checklist.

4 | DISCUSSION

GAS was first used for patients with chronic LBP in 1986; however, the number of investigations studying the usefulness of this measure for patients with chronic LBP has increased over the past 10 years. This systematic review identified several highly transparent studies that found the following: patients with LBP are able to identify and set individualized goals during GAS.[43,44] GAS may be more sensitive to change[37,41] and may measure different aspects of the patient experience as compared with fixed-item patient-reported measures.[37,41,52] In addition, the GAS may have a therapeutic effect while improving patient outcomes[45] and is associated with patient satisfaction.[21,42] Previous research indicates that active patient involvement in establishing physical therapy goals, as is done in GAS, positively influences treatment outcomes and patient perceptions regarding quality of care.[56] In addition to facilitating cooperative goal setting,[57] GAS also impacts patient motivation[22,45]; therefore, healthcare providers may want to include GAS in their management of patients with chronic LBP. Furthermore, GAS has been used to asses patient response to cognitive behavioral approaches,[37,38] which is often included in the management of this patient population (Delitto, LBP Guidelines, 2012). The results of this review suggest that GAS may have a positive impact on the care of patients with chronic LBP because it provides a more sensitive measure of patient outcomes and is associated with greater patient satisfaction.

Hurn et al[34] indicated the need for further work to establish the psychometric properties (ie, reliability, validity, and responsiveness) of GAS scores. Goal setting is already part of routine physical therapy practice; however, the process is highly variable[58] with goals that are traditionally provider generated.[59] Furthermore, GAS procedures (approach and scale, Table 2) vary greatly and the time required to administer GAS for patients with LBP in clinical practice is unknown. This review found five different procedures among the seven included studies. This variability highlights the need for a standardized approach and training for clinicians applying GAS, which will allow for greater comparability of outcomes across studies and facilitate communication among clinicians.

Hurn et al also found that there was significant variability in who administered GAS procedures in the rehabilitation of patients with pediatric, geriatric, cardiac, and neurological disorders, as well as for patients with chronic pain.[34] Of the 15 articles included in Hurn et al's systematic review,[30] GAS was administered by a physical therapist alone in only one study. In the majority of studies (6/15), GAS was administered bv a multidisciplinary team, while it was applied by occupational therapists, geriatricians, or unknown providers in two studies each. GAS was also completed by nursing and rehabilitation counselor in one study each. Our results support these results and found that physiotherapists administered GAS in only two studies, with the remaining studies utilizing occupational therapists or members of multidisciplinary teams. This variability in clinicians applying GAS, combined with the aforementioned variability in procedures, makes it difficult to compare outcomes across studies.

In patient populations with a high degree of variability, such as those with LBP, fixed-item measures are often less responsive to change.[60] Most patients do not simply seek pain relief when seeking interventions for LBP.[61] Furthermore, individual characteristics such as gender and educational attainment may impact what outcomes patients seek from care. Knowledge of patient-initiated and -centered goals will enable the healthcare team to offer interventions that are more individualized and focused toward patient-specific goals, leading to improved outcomes and potentially more focused care.[40]

Our recommendation is not that healthcare providers abandon current traditional fixed-item patient-reported outcome measures (eg, Oswestry disability index, numerical rating scale), but rather that GAS can enhance traditional measures through the identification of individually desired health states for patients with chronic LBP.[22,37,45] We acknowledge that fixed-item measures may not capture what is always meaningful to patients, as Mannion et al[37] found that 22% of goals set during GAS were not included in a traditional outcome measure (Roland-Morris disability questionnaire). Fixed-item outcome measures may be more useful than GAS for measuring disability and it is not clear whether GAS, when fully developed, would capture long-term outcomes as well as existing measures.[37]

A greater appreciation of the impact of LBP on patients' lives may improve the patient experience.[24] It has been recommended that providers focus as much attention on the patient and their experiences as they do on selecting interventions.[62] This appreciation and attention along with collaborative goal setting may improve the patient experience,[24] enhance patient-provider therapeutic alliance,[63] facilitate treatment compliance,[40] increase patient involvement in the decision-making process,[64] and improve the alignment of interventions with common goals. Therefore, patients may be better able to

make decisions when intervention options require trade-offs (eg, symptom management vs functional capacity).[65]

The current focus on patient participation in their care has resulted in the development of standardized tools to measure patient perspectives. For example, the Patient Reported Outcomes Measurement Information System (PROMIS)[66] instrument has been recommended for use in patients with chronic LBP. Furthermore, it has been suggested that commonly used measures, such as the Oswestry disability index,[67] could eventually be replaced by PROMIS measures.[66] Hung et al[68] found that the PROMIS Physical Function and Pain Interference measures resulted in a large range of values for meaningful change, which was related to the methods used to determine MCID (anchor-based vs distribution-based). Based on these results, the authors stressed the importance of judgment when MCIDs are used to guide clinical decisions.[68]

It has also been noted that domains beyond the PROMIS Physical Function and Pain Interference measures, such as social role satisfaction, are meaningful to patients and should be considered in the assessment of patients with chronic LBP.[69] Because it assesses "achievement of "treatment intentions and goal attainment," GAS has been recommended as an adjunct to address the inherent limitations of standard outcomes measures.[70] Furthermore, GAS provides a structure for provider and patient collaboration on goal setting and achievement,[34] which may result in increased patient participation and adherence in their rehabilitation.[71]

4.1 | Limitations

This review has several limitations. The possibility of study identification bias is present because only articles in English were reviewed.[72] Several concerns regarding the use of GAS have been identified, including methodological inconsistency, scale variation, inconsistency in selecting expected outcomes, and difficulty with specifying specific measurable outcomes.[73,74] This was true in the present investigation as the majority of the studies were observational cohorts with inconsistent applications of GAS.

4.2 | Conclusions

Based on this review, GAS shows promise as a patient-centered measure that may be more responsive to change than traditional outcome measures. However, GAS has not been fully developed and validated for use in patients with LBP during rehabilitation. In order to meet the needs of healthcare providers and the impact of LBP on patients, GAS requires further development and evaluation. This review suggests that GAS may have the potential to provide an outcome measure that is more meaningful to patients with LBP than those currently used. This type of measure would also support the therapeutic alliance and collaboration between patients and providers, which facilitate successful outcomes.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Conceptualization: Douglas Haladay, Laura Swisher, Dustin Hardwick
Formal Analysis: Douglas Haladay, Dustin Hardwick
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All authors have read and approved the final version of the manuscript

The corresponding author, Douglas Haladay, had full access to all of the data in this study and takes complete responsibility for the integrity of the data and the accuracy of the data analysis.

TRANSPARENCY STATEMENT

The corresponding author, Douglas Haladay, affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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REFERENCES

1. Marras WS. Occupational low back disorder causation and control. *Ergonomics*. 2000;43(7):880-902. https://doi.org/10.1080/001401300409080
2. How-Ran G, Tanaka S, Halperin WE, Cameron LL. Back pain prevalence in US industry and estimates of lost workdays. *Am J Public Health*. 1999;89(7):1029-1035.
3. Brault MW, Hootman J, Helmick CG, Theis KA, Armour BS. Prevalence and most common causes of disability among adults – United States, 2005. *MMWR Morb Mortal Wkly Rep*. 2009;58(16):421-426.
4. Freburger JK, Holmes GM, Agans RP, et al. The rising prevalence of chronic low back pain. *Arch Intern Med*. 2009;169(3):251-258. https://doi.org/10.1001/archinternmed.2008.543
5. Wu A, March L, Zheng X, et al. Global low back pain prevalence and years lived with disability from 1990 to 2017: estimates from the Global Burden of Disease Study 2017. *Ann Transl Med*. 2020;8(6):299. https://doi.org/10.21037/atm.2020.02.175
6. Dieleman JL, Baral R, Birger M, et al. US spending on personal health care and public health, 1996-2013. *JAMA: J Am Med Assoc*. 2016;316(24):2627-2646. https://doi.org/10.1001/jama.2016.16885

7. Dagenais S, Caro J, Haldeman S. A systematic review of low back pain cost of illness studies in the United States and internationally. *Spine J*. 2008;8(1):8-20. https://doi.org/10.1016/j.spinee.2007.10.005
8. Olafsson G, Jonsson E, Fritzell P, Hägg O, Borgström F. Cost of low back pain: results from a national register study in Sweden. *Eur Spine J*. 2018;27(11):2875-2881. https://doi.org/10.1007/s00586-018-5742-6
9. Wenig CM, Schmidt CO, Kohlmann T, Schweikert B. Costs of back pain in Germany. *Eur J Pain*. 2009;13(3):280-286. https://doi.org/10.1016/j.ejpain.2008.04.005
10. United States Bone and Joint Initiative: The Burden of Musculoskeletal Diseases in the United States (BMUS). Updated 2014. http://www.boneandjointburden.org. Accessed January 29, 2016.
11. Freburger JK, Carey TS, Holmes GM. Physical therapy for chronic low back pain in North Carolina: overuse, underuse, or misuse? *Phys Ther*. 2011;91(4):484-495. https://doi.org/10.2522/ptj.20100281
12. Freburger JK, Holmes GM, Carey TS. Physician referrals to physical therapy for the treatment of musculoskeletal conditions. *Arch Phys Med Rehabil*. 2003;84(12):1839-1849. https://doi.org/10.1016/s0003-9993(03)00375-7
13. Jette AM, Davis KD. A comparison of hospital-based and private outpatient physical therapy practices. *Phys Ther*. 1991;71(5):366-375; discussion 376-81. https://doi.org/10.1093/ptj/71.5.366
14. Jette DU, Halbert J, Iverson C, Miceli E, Shah P. Use of standardized outcome measures in physical therapist practice: perceptions and applications. *Phys Ther*. 2009;89(2):125-135. https://doi.org/10.2522/ptj.20080234
15. Snyder CF, Jensen RE, Segal JB, Wu AW. Patient-reported outcomes (PROs): putting the patient perspective in patient-centered outcomes research. *Med Care*. 2013;51(8 Suppl 3):S73-S79. https://doi.org/10.1097/MLR.0b013e31829b1d84
16. Rathert C, Wyrwich MD, Boren SA. Patient-centered care and outcomes: a systematic review of the literature. *Med Care Res Rev*. 2013;70(4):351-379. https://doi.org/10.1177/1077558712465774
17. Hush JM, Kamper SJ, Stanton TR, Ostelo R, Refshauge KM. Standardized measurement of recovery from nonspecific back pain. *Arch Phys Med Rehabil*. 2012;93(5):849-855. https://doi.org/10.1016/j.apmr.2011.11.035
18. Ostelo RW, Deyo RA, Stratford P, et al. Interpreting change scores for pain and functional status in low back pain: towards international consensus regarding minimal important change. *Spine*. 2008;33(1):90-94. https://doi.org/10.1097/BRS.0b013e31815e3a10
19. Chapman JR, Norvell DC, Hermsmeyer JT, et al. Evaluating common outcomes for measuring treatment success for chronic low back pain. *Spine*. 2011;36(21 Suppl):S54-S68. https://doi.org/10.1097/BRS.0b013e31822ef74d
20. Hush JM, Refshauge KM, Sullivan G, De Souza L, McAuley JH. Do numerical rating scales and the Roland-Morris Disability Questionnaire capture changes that are meaningful to patients with persistent back pain? *Clin Rehabil*. 2010;24(7):648-657. https://doi.org/10.1177/0269215510367975
21. Hazard RG, Spratt KF, McDonough CM, et al. The impact of personal functional goal achievement on patient satisfaction with progress one year following completion of a functional restoration program for chronic disabling spinal disorders. *Spine*. 2009;34(25):2797-2802.
22. Turner-Stokes L. Goal attainment scaling (GAS) in rehabilitation: a practical guide. *Clin Rehabil*. 2009;23(4):362-370. https://doi.org/10.1177/0269215508101742
23. Dworkin RH, Turk DC, Wyrwich KW, et al. Interpreting the clinical importance of treatment outcomes in chronic pain clinical trials: IMMPACT recommendations. *J Pain: Off J Am Pain Soc*. 2008;9(2):105-121. https://doi.org/10.1016/j.jpain.2007.09.005
24. Froud R, Patterson S, Eldridge S, et al. A systematic review and meta-synthesis of the impact of low back pain on people's lives. *BMC Musculoskelet Disord*. 2014;15:50. https://doi.org/10.1186/1471-2474-15-50
25. Searle A, Spink M, Ho A, Chuter V. Exercise interventions for the treatment of chronic low back pain: a systematic review and meta-analysis of randomised controlled trials. *Clin Rehabil*. 2015;29(12):1155-1167. https://doi.org/10.1177/0269215515570379
26. van Middelkoop M, Rubinstein SM, Verhagen AP, Ostelo RW, Koes BW, van Tulder MW. Exercise therapy for chronic nonspecific low-back pain. *Best Pract Res Clin Rheumatol*. 2010;24(2):193-204. https://doi.org/10.1016/j.berh.2010.01.002
27. Hayden JA, van Tulder MW, Malmivaara A, Koes BW. Exercise therapy for treatment of non-specific low back pain. *Cochrane Database Syst Rev*. 2005;3:CD000335. https://doi.org/10.1002/14651858.CD000335.pub2
28. Wang XQ, Zheng JJ, Yu ZW, et al. A meta-analysis of core stability exercise versus general exercise for chronic low back pain. *PloS One*. 2012;7(12):e52082. https://doi.org/10.1371/journal.pone.0052082
29. Macedo LG, Maher CG, Latimer J, McAuley JH. Motor control exercise for persistent, nonspecific low back pain: a systematic review. *Phys Ther*. 2009;89(1):9-25. https://doi.org/10.2522/ptj.20080103
30. Haladay DE, Miller SJ, Challis J, Denegar CR. Quality of systematic reviews on specific spinal stabilization exercise for chronic low back pain. *J Orthop Sports Phys Ther*. 2013;43(4):242-250. https://doi.org/10.2519/jospt.2013.4346
31. Rubinstein SM, Terwee CB, Assendelft WJ, de Boer MR, van Tulder MW. Spinal manipulative therapy for acute low back pain: an update of the cochrane review. *Spine*. 2013;38(3):E158-E177. https://doi.org/10.1097/BRS.0b013e31827dd89d
32. van Middelkoop M, Rubinstein SM, Kuijpers T, et al. A systematic review on the effectiveness of physical and rehabilitation interventions for chronic non-specific low back pain. *Eur Spine J: Off Publ Eur Spine Soc Eur Spinal Deformity Soc Eur Sect Cervical Spine Res Soc*. 2011;20(1):19-39. https://doi.org/10.1007/s00586-010-1518-3
33. Slade SC, Keating JL. Trunk-strengthening exercises for chronic low back pain: a systematic review. *J Manipulative Physiol Ther*. 2006;29(2):163-173. https://doi.org/10.1016/j.jmpt.2005.12.011
34. Hurn J, Kneebone I, Cropley M. Goal setting as an outcome measure: a systematic review. *Clin Rehabil*. 2006;20(9):756-772.
35. Kiresuk TJ, Sherman MRE. Goal attainment scaling: a general method for evaluating comprehensive community mental health programs. *Community Ment Health J*. 1968;4(6):443-453.
36. Bovend'EerdtTJ, BotellRE, WadeDT. Writing SMART rehabilitation goals and achieving goal attainment scaling: a practical guide. *Clin Rehabil*. 2009;23(4):352-361. https://doi.org/10.1177/0269215508101741
37. Mannion AF, Caporaso F, Pulkovski N, Sprott H. Goal attainment scaling as a measure of treatment success after physiotherapy for chronic low back pain. *Rheumatology*. 2010;49(9):1734-1738. https://doi.org/10.1093/rheumatology/keq160
38. Levack WM, Dean SG, Siegert RJ, McPherson KM. Navigating patient-centered goal setting in inpatient stroke rehabilitation: how clinicians control the process to meet perceived professional responsibilities. *Patient Educ Couns*. 2011;85(2):206-213. https://doi.org/10.1016/j.pec.2011.01.011
39. Reuben DB, Tinetti ME. Goal-oriented patient care–an alternative health outcomes paradigm. *N Engl J Med*. 2012;366(9):777-779. https://doi.org/10.1056/NEJMp1113631
40. Levack WM, Taylor K, Siegert RJ, Dean SG, McPherson KM, Weatherall M. Is goal planning in rehabilitation effective? A systematic review. *Clin Rehabil*. 2006;20(9):739-755. https://doi.org/10.1177/0269215506070791
41. Fisher K, Hardie R. Goal attainment scaling in evaluating a multidisciplinary pain management programme. *Clin Rehabil*. 2002;16(8):871-877.
42. Hazard RG, Spratt KF, McDonough CM, et al. Patient-centered evaluation of outcomes from rehabilitation for chronic disabling spinal disorders: the impact of personal goal achievement on patient satisfaction. *Spine J*. 2012;12(12):1132-1137.
43. Mullis R, Hay EM. Goal scaling for low back pain in primary care: development of a semi-structured interview incorporating minimal

important change. *J Eval Clin Pract*. 2010;16(6):1209-1214. https://doi.org/10.1111/j.1365-2753.2009.01296.x
44. Mullis R, Lewis M, Hay EM. What does minimal important change mean to patients? Associations between individualized goal attainment scores and disability, general health status and global change in condition. *J Eval Clin Pract*. 2011;17(2):244-250. https://doi.org/10.1111/j.1365-2753.2010.01429.x
45. Williams RC, Stieg RL. Validity and therapeutic efficacy of individual patient goal attainment procedures in a chronic pain treatment center. *Clin J Pain*. 1986;2(4):219-228.
46. Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Ann Intern Med*. 2009;151(4):264-269, W64. https://doi.org/10.7326/0003-4819-151-4-200908180-00135
47. Group OLoEW. The Oxford Levels of Evidence 2. Oxford Centre for Evidence-Based Medicine. https://www.cebm.ox.ac.uk/resources/levels-of-evidence/ocebm-levels-of-evidence. Accessed September 22, 2020.
48. Wells G, Shea B, O'Connell J, et al. The Newcastle-Ottawa scale (NOS) for assessing the quality of nonrandomised studies in meta-analysis. http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp. Accessed July 7, 2021.
49. Vandenbroucke JP, von Elm E, Altman DG, et al; STROBE InitiativeStrengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. *Epidemiology*. 2007;18(6):805-835. https://doi.org/10.1097/EDE.0b013e3181577511
50. Oremus M, Oremus C, Hall GB, McKinnon MC, ECT & Cognition Systematic Review Team. Inter-rater and test-retest reliability of quality assessments by novice student raters using the Jadad and Newcastle-Ottawa Scales. *BMJ Open*. 2012;2(4):e001368. https://doi.org/10.1136/bmjopen-2012-001368
51. da Costa BR, Cevallos M, Altman DG, Rutjes AWS, Egger M. Uses and misuses of the STROBE statement: bibliographic study. *BMJ Open*. 2011;1(1):e000048. https://doi.org/10.1136/bmjopen-2010-000048
52. Oliver S, Fisher K, Childs S. What psychological and physical changes predict patients' attainment of personally meaningful goals six months following a CBT based pain management intervention? *Disabil Rehabil*. 2017;39(22):2308-2314.
53. Kiresuk TJ, Smith A, Cardillo JE. *Goal attainment scaling: Applications, theory, and measurement*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc; 1994:
54. Mullis R, Lewis M, Hay EM. Testing a model of association between patient identified problems and responses to global measures of health in low back pain patients: a prospective study. *Health and Quality of Life Outcomes*. 2009;7:74.
55. Neira C, Godinho R, Rincón F, Mardones R, Pedroso J. Consequences of the COVID-19 Syndemic for nutritional health: a systematic review. *Nutrients*. 2021;13(4):1168. https://doi.org/10.3390/nu13041168
56. Arnetz JE, Almin I, Bergström K, Franzén Y, Nilsson H. Active patient involvement in the establishment of physical therapy goals: effects on treatment outcome and quality of care. *Adv Physiother*. 2004;6(2):50-69.
57. Ottenbacher KJ, Cusick A. Discriminative versus evaluative assessment: some observations on goal attainment scaling. *Am J Occup Ther: Off Publ Am Occup Ther Assoc*. 1993;47(4):349-354.
58. Scobbie L, Wyke S, Dixon D. Identifying and applying psychological theory to setting and achieving rehabilitation goals. *Clin Rehabil*. 2009;23(4):321-333. https://doi.org/10.1177/0269215509102981
59. Baker SM, Marshak HH, Rice GT, Zimmerman GJ. Patient participation in physical therapy goal setting. *Phys Ther*. 2001;81(5):1118-1126.
60. 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(4):652-659. https://doi.org/10.1016/j.apmr.2007.09.049
61. McRae M, Hancock MJ. Adults attending private physiotherapy practices seek diagnosis, pain relief, improved function, education and prevention: a survey. *J Physiother*. 2017;63(4):250-256. https://doi.org/10.1016/j.jphys.2017.08.002
62. Hopayian K, Notley C. A systematic review of low back pain and sciatica patients' expectations and experiences of health care. *Spine J: Off J North Am Spine Soc*. 2014;14(8):1769-1780. https://doi.org/10.1016/j.spinee.2014.02.029
63. Kidd MO, Bond CH, Bell ML. Patients' perspectives of patient-centredness as important in musculoskeletal physiotherapy interactions: a qualitative study. *Physiotherapy*. 2011;97(2):154-162.
64. Verbeek J, Sengers MJ, Riemens L, Haafkens J. Patient expectations of treatment for back pain: a systematic review of qualitative and quantitative studies. *Spine*. 2004;29(20):2309-2318.
65. Fraenkel L. Incorporating patients' preferences into medical decision making. *Med Care Res Rev*. 2013;70(1 Suppl):80S-93S. https://doi.org/10.1177/1077558712461283
66. Deyo RA, Dworkin SF, Amtmann D, et al. Report of the NIH Task Force on Research Standards for Chronic Low Back Pain. *Spine J*. 2014;14(8):1375-91. https://doi.org/10.1016/j.spinee.2014.05.002.
67. Fairbank JC, Pynsent PB. The Oswestry Disability Index. *Spine (Phila Pa 1976)*. 2000;25(22):2940-2952; discussion 2952.
68. Hung M, Saltzman CL, Kendall R, et al. What are the MCIDs for PROMIS, NDI, and ODI instruments among patients with spinal conditions? *Clin Orthop Relat Res*. 2018;476(10):2027-2036. https://doi.org/10.1097/corr.0000000000000419
69. Lapin B, Davin S, Stilphen M, Benzel E, Katzan IL. Validation of PROMIS CATs and PROMIS Global Health in an Interdisciplinary Pain Program for patients with chronic low back pain. *Spine*. 2020;45(4):E227-E235. https://doi.org/10.1097/brs.0000000000003232
70. Ashford S, Williams H, Nair A, Orridge S, Turner-Stokes L. Categorisation of goals set using Goal Attainment Scaling for treatment of leg spasticity: a multicentre analysis. *Disabil Rehabil*. 2019;41(16):1925-1930. https://doi.org/10.1080/09638288.2018.1451927
71. Wade DT. Goal setting in rehabilitation: an overview of what, why and how. *Clin Rehabil*. 2009;23(4):291-295. https://doi.org/10.1177/0269215509103551
72. Dickersin K, Scherer R, Lefebvre C. Systematic Reviews: Identifying relevant studies for systematic reviews. *BMJ (Clinical Res Ed)*. 1994;309(6964):1286-1291. https://doi.org/10.1136/bmj.309.6964.1286
73. Cytrynbaum S, Ginath Y, Birdwell J, Brandt L. Goal attainment scaling: a critical review. *Eval Q*. 1979;3(1):5-40. https://doi.org/10.1177/0193841x7900300102
74. Lewis AB, Spencer JH Jr, Haas GL, DiVittis A. Goal Attainment Scaling. Relevance and replicability in follow-up of inpatients. *J Nerv Ment Dis*. 1987;175(7):408-418.

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