Goal Attainment Scaling as an Outcome Measure for Randomised Controlled Trials: A Systematic Scoping Review

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Abstract

BACKGROUND: Goal Attainment Scaling (GAS) is an individualised outcome measure which can be used in research settings to assess achievement of participant-important priorities and goals.

METHODS: A systematic scoping review was completed with the objective of: (1) Identifying the healthcare settings in which GAS has been used as an outcome measure. (2) Describing how GAS has been implemented by researchers in those trials. PubMed, CENTRAL, EMBASE and PsycINFO were searched without limits from their inceptions to 1 September 2021 for randomised controlled trials conducted in healthcare settings where GAS was used as an outcome measure for adults. Two reviewers independently completed both the screening and data extraction, with a third adjudicating conflicts.

RESULTS: Of 1,764 articles screened, 37 studies were included. Most trials (86%) were solely undertaken in outpatient settings. They were frequently conducted within the disciplines of rehabilitation (57%), geriatric medicine (24%) and neurology (11%). Sample sizes ranged from 8 to 468, with a mean of 84 participants. GAS was a primary outcome measure in 38% of studies. There were inconsistencies between trials in the use of scales and the calculation of GAS scores. Implementation aspects such as the personnel involved, the training provided, and calibration and review mechanisms, were heterogeneously and scarcely reported.

CONCLUSIONS: GAS has been used as an outcome measure across a wide range of disciplines and trial settings. However, there are inconsistencies in how it has been applied and implemented. Developing a cross-disciplinary practical guide to support a degree of standardisation in its implementation may be beneficial in increasing the reliability and comparability of trial results.

Background

Goal Attainment Scaling (GAS) is a method for scoring the extent to which an individual's goals are achieved[1]. It was first developed in the 1960s for the assessment of community mental health programs[2,3]. Since then it has been used in both clinical and research settings across various healthcare disciplines including rehabilitation[4-6], geriatric medicine[7,8], community health[9] and drug trials[10]. Research supports its validity[11-13], reliability[11,12] and responsiveness[5,7,14].

The basic steps of GAS include identifyinggoals; defining the current (baseline) status; identifying potentially better and worse outcomes; weighting the goals; and, at follow-up comparing current status to baseline status[15]. For each goal, possible outcomes are usually graded on a five-point scale between -2 and +2[2]. Achievement of the expected level is scored at 0. Better outcomes are scored at +1 (somewhat better than expected) or +2 (much better than expected). Worse outcomes are scored at -1 (somewhat less than expected) or -2 (much less than expected).

GAS has several strengths. It provides an avenue for patient involvement in priority-setting and care planning[6,16,17], ensures that outcomes are patient-important, [18]and fosters better communication with

clinicians[19,20]. It can also be applied to heterogenous patient groups in research settings where other measures may not be suitable[21-23]. These benefits are increasingly valued as healthcare moves more towards person-centred care[24]. GAS allows outcomes to be patient-led, in contrast to the traditional clinician- or researcher-led models which tend to focus on disease processes or surrogate outcomes[17,18,20,24,25].

The objectives of this systematic scoping review are to (1) identify the healthcare settings in which GAS has been used as an outcome measure for randomised controlled trials and (2) describe how GAS has been implemented by researchers in those trials.

Methods

The protocol for this systematic scoping review was registered with PROSPERO (CRD42021237541).

The PubMed, CENTRAL, EMBASE and PsycINFO electronic databases were searched for articles published from their respective inceptions through to 1 September 2021. To allow for an all-inclusive result, a keyword search was undertaken of " 'goal attainment scaling' OR 'goal attainment scal*' " without any limits.

Publications were eligible for inclusion if they were written in English, were published or "in press" at the search date, included only participants aged 18 and over, were conducted in healthcare settings (including outpatient and community health), and had a randomised or quasi-randomised controlled trial design where GAS was an outcome measure.

Articles were excluded if they did not meet the stated inclusion criteria. Specifically, this included studies where a caregiver rather than the patient set goals, studies where the design was not a randomised controlled trial, if GAS was an intervention (not an outcome measure), or where a modified GAS method was used (i.e. GAS-Hem or GAS-Light).

One author (BL) completed the searches. Two reviewers (BL and DJ) used Covidence®[26] to independently screen titles and abstracts, and complete full text reviews of potentially relevant articles. Any conflicts were reviewed and resolved by a third reviewer (AV).

A data-charting form was developed and piloted on three studies by two reviewers (BL and DJ). This form was then finalised and loaded into Covidence® for data extraction. Two reviewers (BL and DJ) independently completed the data-charting for each article, with a third reviewer (AV) adjudicatingany conflicts.

Information was extracted in relation to the setting in which GAS was used as an outcome measure. Specifically: location of study; number of study sites; discipline; trial design; population; sample size; age; intervention; comparator; and, outcome measure type (i.e. primary or secondary outcome).

Information relating to GAS implementation included personnel involved; training provided; calibration and review processes; administration process; number of goals set; goal domains; scale used; approach to scoring baseline performance; time to complete; support provided to participants; review interval; approach to scoring; calculation used for GAS score; action taken after review; and, use of existing GAS guidelines.

The data collected underwent narrative synthesis, and descriptive statistics where possible.

Results

Search results

The primary search yielded 2,884 articles. After removal of duplicates, 1,764 abstracts underwent screening. A total of 117 articles proceeded to full-text review, with 80 of these excluded as they did not meet the inclusion criteria. Ultimately 37 studies were included. Figure 1 provides an overview of the selection process resulting from the search run on 1 September 2021.

Study and participant characteristics

A summary of included study and participant characteristics are provided in Table 1. Over half of the studies were completed in the rehabilitation discipline (57%, n=21, where ‘n’ is the number of studies), with a significant number also completed in geriatric care (24%, n=9) and neurology (11%, n=4). Most studies were at a single centre (60%, n=22), and only two studies included (5%) participants from two or more countries.

The majority (86%) of studies were conducted in an outpatient setting, which included community-based or home-based delivery of an intervention or outcome measure. The remainder (14%) were either conducted entirely in the inpatient setting or in a mixed inpatient and outpatient setting.

Sample sizes varied from 8 to 468 participants, with a median of 50 (interquartile range 83). Most frequently, participants were stroke survivors (35%, n=13), had a brain injury (19%, n=7), or were community-dwelling older people (16%, n=6).

A broad range of interventions were reported including medications (botulinum toxin), procedures (electrical stimulator-guided obturator nerve block), therapy (internet-based cognitive behavioural therapy) and goal management training.

GAS was a primary outcome in 14 (38%) studies and a secondary outcome in 23 studies (62%).

Application of the GAS tool

Table 2 provides an overview of the approaches taken by researchers in their application of GAS as an outcome measure.

Goals set in GAS are typically scaled to five possible levels, from -2 through to +2[1-3]. This five-point scale was used in 73% (n=27) of the studies, with one other using a five-point scale but with a range from -1 to +3. Three studies used a six-point scale (-3 to +2)[27-29], and one a seven-point scale (-2 to +4)[30]. Five studies (14%) did not report their approach[31-35].

The scoring of baseline performance on the GAS scale varied between studies. Most studies (65%, n=24) did not report it. Where it was reported, -1 was the most frequent (16%, n=6).

There was heterogeneity in the calculation and reporting of GAS outcomes. Most commonly a T-score was derived (49%, n=18). Eight studies (22%) used raw scores, and six (16%) used other approaches including a mix of T-score and raw score. Five (14%) did not specify how their calculation was undertaken.

Personnel, training and guidance

The staff responsible for administering GAS differed between studies. This was not reported in ten studies (27%) and was the responsibility of the physiotherapist or the occupational therapist in 11 (30%). In the remaining 16 studies (43%) there were a mix of healthcare professionals involved including psychologists, research nurses and doctors.

The nature of the training provided to the personnel administering GAS was not articulated in 29 (78%) of the studies. When reported, there was a variable amount of detail given. Three studies specifically mentioned undergoing a simulationor mock goal setting session

Eight (22%) studies in this review described using a GAS guide[1,4,36]. Whilst these guides are primarily written for rehabilitation medicine, three of the studies referencing them were not conducted in rehabilitation settings.

Calibration and scoring

In four studies (11%), some form of calibration or review of goals was undertaken, each with a different approach. One study[37] reported that goals were finalised at a team conference, and a blinded geriatrician assessedthe reliability of the goal setting. In two studies[38,39], therapists worked with the participant to ensure their goals were realistic. One study[28] undertook a third-party review of the first three GAS administered by each investigator.

Scoring of goal attainment was often not clearly reported, or not commented on at all. In seven studies (19%) the attainment score was based on participant self-report, in two (5%) it was based on objective observation, and in one (3%) it was a mix of both self-report and observation. The use of a blinded assessor or third-party reviewer was mentioned in several studies, but it is unclear whether they relied on assessor observation or on participant self-report.

Other implementation aspects

Predetermined goal domains were offered in 18 (49%) studies. The type and number of domains varied. In one study[40] participants who had burns were asked to set goals in four domains: mental health, physical health, vocational and social. In another[41] community-dwelling older adults were asked to set a mobility goal. Thirteen studies (35%) did not comment on the number of goals that participants were required to set. Only one study[42] reported the time allocated to set goals (30 minutes).

Predominantly GAS was administered face-to-face. Three studies reported utilising phone for either the setting or reviewing of goals. One study[39] reported that a copy of the goals were provided to the participant.

Discussion

This systematic scoping review provides insights into the way GAS has been used and implemented in research settings. Importantly, it has been shown that GAS as a trial outcome measure isapplicable and feasible across a range of populations, disciplines, healthcare settings and interventions. Trials have ranged from single sites with small sample sizes through to multi-national and multi-site studies with sample sizes of more than 450 participants.

The implementation of GAS is known to have challenges. These include a lack of specificity around written goals and scales[6,19], the time taken for the process[6,18,21,43], and suboptimal facilitator knowledge of the participant, goal domain or the GAS process[1,44]. This review highlights other potential issues given some aspects of GAS are inconsistently appliedparticularly in the choice of scales and the calculation and reporting of the final GAS scores.

The use of a five-point scale (-2 to +2) is recognised as the preferred approach for GAS[1-3], which statistical analysis supports[22]. Our review shows that 28% of studies either took an alternate approach, or did not explicitly report which scale was used.

Prior reports show there are different methods to how GAS scores are calculated and reported in research, with options including: raw scores; the sum of differences between baseline and outcome; mean of raw scores; and, use of a T-score[19]. The T-score is frequently used, particularly for its ability to normalise GAS scores[19], and this was reflected in our review with the T-score being used most (49%). How the GAS scores were calculated was not clearly reported in five studies (14%).

The variability in how baseline performance was handled is consistent with prior commentary[23]. When Kiresuk and Sherman described GAS, they did not provide guidance on this[2,3]. Most studies (65%) did not report their approach, and consistency was absent across the others. This heterogeneity may reflect the specific populations, or an intent of researchers to allow it to be tailored to each participant.

Inconsistencies in how GAS is applied, and in how it varies from the originally described process[2,3], potentially threaten its robustness as an outcome measure. This is further complicated by a lack of

information provided in publications on how GAS is practically implemented, despite a growing call for this to occur[19,23,44]. Steenbeek and colleagues note that in the absence of guidelines for GAS development and scoring, researchers should be detailing their implementation strategy to facilitate reproducibility [45]. Our review shows that this is not occurring commonly. The personnel that administered GAS was not reported in 27% of the trials, most studies (78%) did not articulate the training and support provided, and only 11% had a review or calibration process. The incomplete reporting also included a lack of detail on how goal attainment was scored.

The substantial heterogeneity and incomplete reporting of how GAS has been measured and applied in clinical trials makes the interpretation and comparison of trial results challenging, not just for this review but more broadly in research and clinical practice. Potential implications of inconsistent GAS implementation also include introducing risk of bias if delivery is too leading, or scales are poorly constructed and open to selective interpretation when being measured at the time of assessment.

Suggestions to address concerns with implementation include: requirements for adequate training and procedures[19,23,44,45]; quality controls such as third-party review of the goals set and the outcomes attained[6,7,19,23,44,46,47]; and, confirmation that goals are related to the intervention being assessed[44,47]. Such steps would also favourably affect the content validity and reliability of GAS, which has been criticised by some[21,44].

Practical guidelines[1,4] have been published to address some of the issues noted above. Only 22% of the trials specifically noted whether they adhered to the Turner-Stokes[1] or Bovend'Eerdt[4] guidelines, both of which were written with a focus on rehabilitation medicine[1,4]. Guidance that is more inter-disciplinary in nature may be beneficial.

Limitations

The lack of granularity in the published protocols and methodologylimited robust appraisal of GAS as an outcome measure. Actions may have been taken that were not documented in the published manuscripts.

Only those studies with a randomised controlled trial design and adult participants were included in the systematic scoping review. This may have limited insights into the scope of findings and transferability.

Conclusion

Given its demonstrated ability to be deployed as an outcome measure in such a diverse mix of trials, GAS is a valuable tool for researchers to assess participant-important priorities. It holds potential for more widespread use to support person-centred care. Inconsistencies identified in how GAS is applied, and variations in implementation and reporting, raise the need for greater standardisation.

Abbreviations

Declarations

1. **Ethics approval and consent to participate**

Ethics approval is not applicable to this article.

2. **Consent for publication**

All authors consent to publication.

3. **Availability of data and materials**

Data sharing is not applicable to this article as no datasets were generated.

4. **Competing interests**

There are no competing interests to disclose.

5. **Funding**

There is no funding to disclose.

6. **Authors' contributions**

B.L wrote the protocol, which all authors reviewed. B.L. and D.J. completed all screening and data extraction, with A.V. adjudicating any conflicts. B.L. prepared the figures and tables, which all authors reviewed. B.L. wrote the first draft of the main manuscript, which all authors then reviewed, edited, and endorsed.

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Tables

Table 1: Overview of study and participant characteristics

Paper Lead author Publication year	**Study setting** Discipline Care setting Country (# of study sites)	**Participant Characteristics** Patient population Sample size Age: intervention group mean (SD)	**Intervention**	**GAS Utility**
Alanbay[1] 2020	Rehabilitation Inpatient and outpatient Turkey (1)	Hemiplegic shoulder pain post stroke 30 65.2 (10.2) years	Pulsed radiofrequency to the suprascapular nerve	Secondary outcome
Berger[2] 2009	Psychiatry Outpatient Switzerland (1)	Social phobia 52 28.1 (5.4) years	Internet-based cognitive behavioural therapy	Secondary outcome
Bertens[3] 2015	Rehabilitation Outpatient Netherlands, Italy (4)	Brain injury with executive dysfunction 60 49.7 (13.6)	Combined errorless learning and goal management training	Secondary outcome
Bögels[4] 2014	Psychiatry Outpatient Netherlands (1)	Social anxiety disorder 47 30.7 (9.7) years	Psychodynamic psychotherapy	Secondary outcome
Bovend'Eerdt[5] 2010	Rehabilitation Inpatient and outpatient UK (1)	Stroke, brain injury, multiple sclerosis 30 51.2 (11.75) years	Motor imagery embedded in usual therapy	Primary outcome
Carbrera-Martos[6] 2019	Neurology Outpatient Spain (1)	Parkinson's disease 50 69.45 (12.32) years	Therapeutic goal setting and physical training	Primary outcome

Cadilhac[7] 2020	Neurology Outpatient Australia (1)	Stroke 54 69 (11) years	Comprehensive eHealth program (iVERVE system)	Primary outcome
Dahlberg[8] 2007	Rehabilitation Outpatient USA (1)	Brain injury with communication deficits 52 42.43 (11.86)	Group sessions to improve social communication	Primary outcome
Ertzgaard[9] 2018	Rehabilitation Outpatient Sweden (2)	Spasticity 31 47.9 years *	Assistive technology - a garment with integrated electrodes switched 'on'	Primary outcome
Fairhall[10] 2012	Geriatric medicine Outpatient Australia (1)	Frail community-dwelling older people 241 83.4 (5.81) years	Multifactorial, inter-disciplinary intervention targeting frailty	Secondary outcome
Harrison-Felix[11] 2018	Rehabilitation Outpatient USA (6)	Brain injury with social difficulties 179 44.74 (14.52) years	Interactive group treatment	Secondary outcome
Hart[12] 2017	Rehabilitation Outpatient USA (1)	Moderate/severe traumatic brain injury 8 23.8 (4.3)	Goal-related implementation intervention	Secondary outcome
Herdman[13] 2019	Geriatric medicine Outpatient Canada (1)	Community-dwelling older adults 55 70.2 (8.4)	Group psychoeducation, lifestyle coaching, memory-strategy training	Primary outcome
Högg[14] 2020	Rehabilitation Inpatient Germany (1)	Stroke with arm hemiparesis 43 63 (14)	High-intensity arm resistance training	Secondary outcome
	Rehabilitation	Stroke with arm	Two intervention arms: 1.	Secondary

Hung[15] 2019	Outpatient Taiwan (3)	impairment 30 56.6 (9.5) years †	Unilateral hybrid therapy; and, 2. Bilateral hybrid therapy (robot-assisted technology and arm training)	outcome
Klamroth-Marganska[16] 2014	Rehabilitation Outpatient Switzerland (4)	Stroke with motor impairments 77 55 (13) years	Robotic therapy	Secondary outcome
Lam[17] 2015	Geriatric medicine Inpatient China (6)	Hip adductor spasticity 26 78.1 (12.9) years	Ultrasound and electrical stimulator-guided obturator nerve block with phenol	Secondary outcome
Lannin[18] 2018	Rehabilitation Outpatient Australia (1)	Stroke with arm or leg spasticity 37 62 (9) years	Botulinum toxin and 8 weeks of intensive therapy	Primary outcome
Lannin[19] 2020	Rehabilitation Outpatient Australia (7)	Stroke with arm spasticity 140 62 (115) years	Botulinum toxin and evidence-based movement training	Primary outcome
Leroi[20] 2014	Neurology Outpatient UK (1)	Dementia associated with Parkinson's 25 76.7 (7.8) years	Memantine	Primary outcome
Maggiani[21] 2016	Neurology Outpatient Italy (1)	Amyotrophic lateral sclerosis 14 54 (11.6) years	Osteopathic manual treatment	Secondary outcome
McCrory[22] 2009	Rehabilitation Outpatient Australia (6)	Stroke with arm spasticity 96 59.7 (12.2) years	Botulinum toxin	Secondary outcome
McMahon[23]	Geriatric medicine	Community-dwelling older	'Ready-Steady' - motivational support and fall-reducing	Secondary outcome

2016	Outpatient USA (2)	adults 30 83.6 (4.7) years ‡	physical activities	
McPherson[24] 2009	Rehabilitation Inpatient and outpatient New Zealand (3)	Brain injury 34 29 and 28 years §	Two intervention arms: 1. Goal management training; and, 2. Identity-oriented goals	Secondary outcome
Oliveira[25] 2019	Geriatric medicine Outpatient Australia (1)	Community-dwelling older adults 131 71 (6) years	Physiotherapy, telephone coaching, tailored fall prevention advice and brochure, and pedometer	Primary outcome
Peirone[26] 2014	Rehabilitation Outpatient Italy (1)	Brain injury with balance impairments 16 39.62 (13.89) years	Individualised dual-task home-based programme	Secondary outcome
Phillips[27] 2012	Rehabilitation Outpatient UK (2)	Charcot-Marie Tooth 8 62.3 years *	Silicone ankle-foot orthoses	Secondary outcome
Ramos-Murguialday[28] 2013	Rehabilitation Outpatient Germany (1)	Severe hand weakness 32 49.3 (12.5) years	Brain-machine training	Secondary outcome
Rockwood[29] 2000	Geriatric medicine Outpatient Canada (1)	Rural-dwelling, frail older persons 182 81.4 (7.2) years	Comprehensive geriatric assessment	Primary outcome
Rockwood[30] 2006	Geriatric medicine Outpatient Canada (10)	Alzheimer's disease 130 77 (8) years	Galantamine	Primary outcome

Shearer[31] 2010	Geriatric medicine Outpatient USA (1)	Community-dwelling older adults 59 77.77 (9.25) years ‡	Health empowerment intervention	Secondary outcome
Skubik-Peplaski[32] 2017	Rehabilitation Outpatient USA (1)	Stroke 16 47 (20.9) years	Repetitive task practice	Secondary outcome
Wallace[33] 2020	Rehabilitation Outpatient UK (1)	Stroke spasticity 28 50 (18) years	Onabotulinumtoxin A	Secondary outcome
Ward[34] 2014	Rehabilitation Outpatient Multiple (n/a)	Stroke spasticity 273 64.11 years §	Onabotulinumtoxin A	Secondary outcome
Wein[35] 2018	Rehabilitation Outpatient Multiple (60)	Stroke spasticity to leg 468 56 (12.6) years	Onabotulinumtoxin A	Secondary outcome
Wiechman[36] 2015	Surgery Outpatient USA (1)	Burns 81 43.23 (16.92) years	Expanded care coordinator services	Primary outcome
Wilz[37] 2011	Geriatric medicine Outpatient Germany (2)	Family caregivers of dementia patients 229 61.58 (10.56 years)	Cognitive behavioural therapy	Primary outcome

(*SD not provided; † combined figure for both intervention arms; ‡ combined age of intervention and comparator group; § median age for the two respective intervention groups)

Table 2: Approaches taken in the application of GAS

Approaches to application of GAS	Frequency*
Scale used:	
- 5-point scale (-2 to +2)	- 27 (73%)
- Other	- 5 (14%)
- Not reported	- 5 (14%)
Scoring of baseline performance:	
- -2 (much less than expected)	- 1 (3%)
- -1 (somewhat less than expected)	- 6 (16%)
- 0 (expected)	- 4 (11%)
- Other	- 2 (5%)
- Not reported	- 24 (65%)
Calculation of GAS score for analysis:	
- Raw score	- 8 (22%)
- Sum of differences between baseline and outcome	- 0 (0%)
- Mean of raw scores	- 0 (0%)
- T-score	- 18 (49%)
- Other (including mix of above)	- 6 (16%)
- Not reported	- 5 (14%)
Overview of personnel involved:	
- Reported	- 27 (73%)
- Not reported	- 10 (27%)
Overview of training provided:	
- Reported	- 8 (22%)
- Not reported	- 29 (78%)
Calibration and review process:	
- Reported	- 4 (11%)
- Not reported	- 33 (89%)
Scoring of goal attainment:	
- Self-report	- 7 (19%)
- Observed	- 2 (5%)

-	Other (including mix of above)	-	3 (8%)
-	Not reported	-	25 (68%)

(*denominator is 37, the total number of studies included in this review; not all percentages total to 100% given the use of rounding to the nearest whole number)

Figures

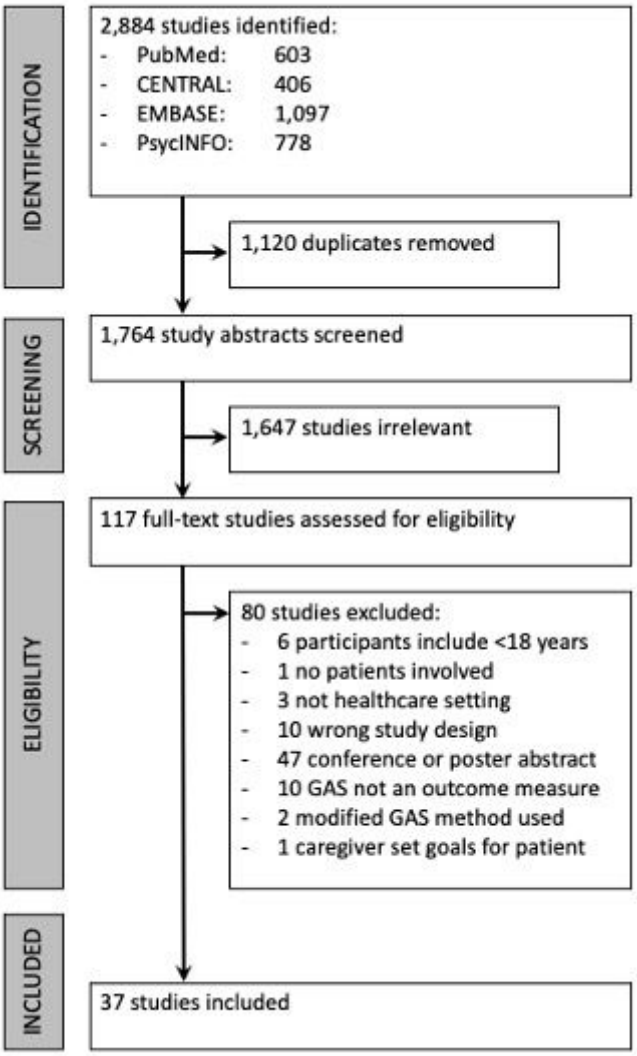

Figure 1

PRISMA flow diagram for study selection.