Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Measuring Quality of Life in Children with Lower-Limb Differences: German Translation and Validation of the GOAL-LD™

Bjoern Vogt
bjoern.vogt@ukmuenster.de
University Hospital Münster
Leona Seifert
University Hospital Münster
Georg Gosheger
University Hospital Münster
Robert Roedl
University Hospital Münster
Jan Duedal Rölfing
Aarhus University Hospital
Anna-Kathrin Hell
University Medical Center
Unni G. Narayanan
Hospital for Sick Children
Gregor Toporowski
University Hospital Münster

Research Article

Keywords: patient-reported outcome measures, health-related quality of life, GOAL-LD™, lower limb differences, children, translation and cultural adaptation

Posted Date: June 26th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10059573/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Purpose

Patient-reported outcome measures (PROMs) have gained increasing relevance in clinical research as they provide direct insight into patients' experiences, functional status, and perceived well-being during and after treatment. In paediatric orthopaedics, lower-limb differences (LD) represent a clinically relevant condition, yet condition-specific PROMs capturing health-related quality of life (HRQoL) remain limited. This study aimed to translate and culturally adapt the Gait Outcomes Assessment List for Children with Lower-Limb Difference (GOAL-LD™) into German to ensure its applicability and relevance for German-speaking patients.

Methods

The translation and cultural adaptation followed the International Society for Pharmacoeconomics and Outcome Research (ISPOR) guidelines. The process comprised three independent forward translations, a harmonised version, a backward translation into English, an expert panel review, and cognitive debriefing interviews with 30 participants with LDs. Feedback from each step informed iterative revisions, ultimately resulting in the finalized German GOAL-LD™.

Results

The mean age of participants was 13 ± 2 years (range 9–18). Internal consistency was excellent, with a Cronbach's alpha of 0.91 for the overall instrument. All subscales demonstrated normal score distributions except for the "Pain and Endurance" domain, which showed moderate internal consistency (α = 0.64), likely due to ceiling effects in several subscales and limited score variability.

Conclusion

LDs can substantially affect the HRQoL of affected children, underscoring the need for valid and comprehensible PROMs to capture patient perspectives reliably. The German version of the GOAL-LD™ has now been successfully translated and culturally adapted and is ready for application in clinical practice and research.

Introduction

Lower-limb differences (LDs) comprise a heterogeneous group of congenital, idiopathic, or acquired conditions affecting limb morphology, alignment, and function. They include a variety of deformities such as leg length discrepancy, angular or rotational malalignment. The deformities range from mild to severe defects that impact growth, gait, or motor function [1]. A majority of affected patients present

with additional congenital anomalies, increasing the risk of systemic comorbidities [2]. Large cross-sectional studies report a prevalence of LDs in children ranging from 17% to 32% [3, 4].

Patients with LDs report functional limitations, worse mental health, as well as poor self-image [5]. To assess the effect of LDs on patients' health-related quality of life (HRQoL), validated patient-reported outcome measures (PROMs) aim to capture symptoms, functioning, and well-being [5].

LDs in children and adolescents differ fundamentally from those in adults due to ongoing skeletal growth and age-specific anatomy, requiring high expertise and specific treatment protocols [6, 7]. There are various conservative and surgical treatment options for LDs in children, covering a spectrum from shoe lifts and orthotic treatment to growth modulation and leg lengthening [8].

Given this complexity, incorporating the patient's perspective is essential for adequately evaluating treatment effects and supporting informed, shared decision-making. Validated PROMs provide structured insight into symptoms, functional limitations, and well-being from the child's perspective, thereby complementing clinical and radiographic assessments [9]. However, generic paediatric PROMs do not adequately address LD-specific issues such as gait-related limitations, fatigue, or concerns regarding limb appearance [9, 10].

The GOAL-LD™ (Gait Outcomes Assessment List for Lower-Limb Difference) is a condition-specific PROM designed specifically for children with LD [10, 11]. It focuses on functional and quality-of-life outcomes for children who have gait and mobility challenges due to LD. Items such as pain, fatigue, and body image/self-esteem are emphasized, as they are highly relevant to this population, and the instrument incorporates both patient- and parent-prioritised concerns [10].

Developed through modification of the original GOAL™ questionnaire and refined through extensive field-testing in children with LDs, the GOAL-LD™ has demonstrated strong psychometric properties in English-speaking populations [10].

To enable its use in German-speaking clinical and research settings, a culturally appropriate and linguistically equivalent version is needed. The aim of this study was therefore to translate and cross-culturally adapt the GOAL-LD™ into German following established international guidelines.

Patients and methods

Study Design

This study was conducted between 2024 and 2025 as a cross-sectional study involving translation and cross-cultural adaptation of the GOAL-LD™, followed by psychometric evaluation. Official permission and a user license for the translation of the GOAL-LD™ questionnaire were obtained from the original developers. The study protocol was approved by the responsible regional ethics committee (reference 2021-556-f-S) and conducted in accordance with the Declaration of Helsinki.

Translation process

The translation and adaptation process closely followed the Translation Guidelines by the PSCORE Program / SickKids [12], which are aligned with internationally accepted standards for cross-cultural adaptation of PROMs [13].

Step 1: Forward translation

Three independent translators, whose native language was German and who were fluent in English, translated the original English GOAL-LD™ into German. According to the guidelines, two translators had a healthcare background (familiar with the topic), and one had no specific medical knowledge, to ensure diverse perspectives. Three translators (a professional translator, a medical student, and a clinician) were involved to increase robustness. All versions were kept independent.

Step 2: Synthesis

The translators and the research team convened to compare the independent forward translations. Discrepancies in wording, style, or conceptual meaning were discussed, and a consensus German translation was produced, integrating the best elements of each individual translation.

Step 3: Backward translation

One independent professional back-translator, whose native language was English and who was fluent in German, translated the synthesized German version back into English. The back-translation was compared to the original English questionnaire by the developers and the research team, and discrepancies were resolved through discussion.

Step 4: Expert committee review

An expert committee, including all translators (forward and back), clinicians familiar with paediatric orthopaedics, methodological experts, and language specialists, reviewed all translation versions and the original instrument. Their function was to consolidate semantic, idiomatic, experiential (cultural), and conceptual equivalence, producing a pre-final German version. All decisions and rationale were documented in a translation log.

Step 5: Pretesting

The pre-final German version was tested via cognitive debriefing interviews with a sample of 30 patients having LDs, recruited in the orthopaedic outpatient clinic at our tertiary-care referral university hospital. Participants had to be fluent in German and cognitively able to engage with the questionnaire; those with language or comprehension barriers were excluded. Individual interviews explored each item’s clarity, comprehensibility, cultural relevance, and appropriateness of response options. Items misunderstood by more than 15% of respondents, per guidelines, were flagged, revised by the expert committee, and retested.

Step 6: Finalization and proofreading

Based on feedback, no modifications were required based on cognitive interview feedback. The final German GOAL-LD™ version was proofread by German clinicians to ensure medical accuracy. Furthermore, this version was approved by both the translation team and the original developers for deployment.

The finalized questionnaire was implemented in REDCap (Research Electronic Data Capture) for data capture, management, and analysis. The German version of the GOAL-LD™ is available upon request from the developers in accordance with licensing requirements.

Psychometric evaluation

The following psychometric properties were examined:

1. Descriptive and item analysis

- Demographic and clinical characteristics were summarized with means, standard deviations, medians, and interquartile range (IQR) as appropriate.
- For each item: response distribution, missing data frequency, and floor/ceiling effects (considered significant if > 15% responses at extremes).

2. Internal consistency

- Cronbach's α coefficient for the overall scale and subscales/domains; $\alpha \geq 0.70$ was considered acceptable [14].

3. Item–Total correlations

- Each item's correlation with its domain's total score (or with the overall score) was computed (Spearman's rho) to assess discriminative capacity and homogeneity.

4. Construct validity / Factor structure

- Exploratory Factor Analysis (EFA) using principal component extraction and varimax rotation, and the percentage of explained variance was calculated for each component. The number of factors was guided by eigenvalues > 1 and by inspection of the scree plot.
- Items with loadings below 0.40 or cross-loadings > 0.30 were examined carefully and possibly considered for revision or removal.

All analyses were conducted using SPSS Statistics v30.0.0.0 (IBM, SPSS, Inc., Chicago, IL, USA). A two-sided significance level of $p < 0.05$ was adopted.

Results

Thirty patients with a mean age of 13 ± 2 years (range 9–18) with different LDs participated in the interviews. Details on demographic data are presented in Table 1, and detailed individual patient characteristics are provided in Supplementary Table S1.

Table 1
Demographics of the participants

Variable		
Age (± SD); years		13 ± 2
Sex (f:m)		12:18
Diagnosis	Posttraumatic/Postinfectious LLD	7
	Congenital LLD	6
	Secondary LLD	2
	Tall/Short stature	3
	Coronal angular deformity	7
	Other	5

(f=female; m=male; LLD = leg length discrepancy; SD=standard deviation)

Feasibility

No participant reported any problems with the usability or layout of the online version of the questionnaire. All patients stated that the questionnaire was easy to complete and not time-consuming. The reported completion time ranged from 10 to 20 minutes. However, minor comprehension difficulties (< 15%) were noted during the cognitive debriefing interviews, particularly with individual terms such as “hinken” or the phrase “importance of goal”. Overall, both children and adolescents found the phrasing and wording of the items clear and appropriate for their age. No major linguistic or conceptual problems were identified, and based on interview feedback, no modifications were required for the final version.

Item analysis

The results of the German GOAL-LD™ pretesting are summarized in Table 2. Given the ordinal nature of Likert-type data, distributional assumptions were interpreted cautiously. Missing data per item were < 5%. Inter-item correlations ranged from 0.36 to 0.71, indicating sufficient homogeneity without redundancy.

Table 2
Reliability (Cronbach's α, item–total correlation) and construct validity (explained variance, floor and ceiling effects) of the German GOAL-LD™ total score and its domains

Domain	Mean ± SD	Mean floor effect (%)	Ceiling effect (%)	Cronbach's α	Item–Total correlation ± SD	Explained variance (%±SD)
Walking and getting around	75.6 ± 17.5	3.6	33.9	0.93	0.71 ± 0.09	60.8 ± 14.2
Pain/Discomfort/Fatigue	65.8 ± 13.0	3.8	48.6	0.64	0.36 ± 0.18	36.6 ± 9.4
Physical activities, games and recreation	74.8 ± 22.6	7.1	1.5	0.92	0.71 ± 0.11	62.1 ± 13.7
Gait appearance	72.4 ± 20.0	5.6	32.8	0.87	0.68 ± 0.13	61.4 ± 12.5
Use of braces and assistive devices	76.5 ± 21.6	0.0	0.0	0.73	0.52 ± 0.16	53.7 ± 10.8
Body image and self-esteem	70.3 ± 14.2	0.4	25.0	0.79	0.54 ± 0.12	46.0 ± 11.6
Total	73.6 ± 11.8	0.0	0.6	0.91	0.49 ± 0.21	36.3 ± 7.0

(SD=standard deviation)

Floor and ceiling effects

Across all items, floor effects remained < 5%, indicating that lower response categories were rarely selected. Ceiling effects, however, were present in several domains, with 18% to 48% of participants reaching the maximum possible score. Importantly, no ceiling effect was observed for the total GOAL-LD™ score, as the combination of multiple domains made achieving the overall maximum practically impossible. The pronounced subscale ceiling effects are therefore interpreted as reflecting the high functional level of the study population, rather than a limitation of the translated instrument.

Internal consistency

Internal consistency of the total German GOAL-LD™ scale was excellent (Cronbach's α = 0.91). The mean corrected item–total correlation for the total scale was 0.49 ± 0.21, indicating moderate internal coherence across all items. Subscale α-values ranged from 0.64 to 0.93, demonstrating acceptable to excellent reliability. Domains A (α = 0.93), C (α = 0.92), and D (α = 0.87) showed very good and excellent internal consistency, E (α = 0.73) and F (α = 0.79) good reliability, whereas B (α = 0.64) indicated

moderate consistency likely related to ceiling effects and limited response variance. Mean corrected item–total correlations across subscales ranged from 0.36 ± 0.18 to 0.71 ± 0.11.

Construct validity

Principal component analysis supported the multidimensional structure of the questionnaire. The variance explained by the first principal component ranged from 36.6% (domain B) to 62.1% (domain C) across subscales, and 36.3% for the total dataset. All items showed factor loadings > 0.40 on their respective components with minimal cross-loadings, supporting conceptual equivalence to the original English version.

Discussion

Children and adolescents with LDs experience a wide range of functional limitations and psychosocial challenges that are not fully captured by clinical or radiographic parameters alone [1, 11, 15]. Several studies have shown that commonly used orthopaedic PROMs frequently lack content validity or fail to address domains that are particularly relevant to this population, such as gait-related restrictions, fatigue, and body image concerns [1, 13].

The GOAL-LD™ was specifically developed to address these domains in paediatric LDs populations, and providing a German version through structured translation, cultural adaptation, and cognitive debriefing represents an important step toward standardised, patient-centred outcome assessment in German-speaking clinical and research settings [10, 13].

The adaptation process resulted in a version that was well accepted and understood by the target group. Most participants reported that the questionnaire was easy to complete and clearly worded, and no items required formal revision after cognitive interviewing. Occasional comprehension issues with individual terms (e.g., “hinken”) could be resolved by a brief explanation and did not point to systematic linguistic problems. It is important to note that not all participants in the study were native German speakers but were fluent in German, which may have contributed to these minor comprehension issues. However, after a brief clarification by the interviewer, the intended meaning of the terms became clear to all participants. Another comprehension difficulty arose when interpreting the phrase “importance of goal”. This may partly be due to insufficient attention to the task instructions, as some patients tended to rely on the instructor for clarification rather than reading the task carefully. The reported completion time of 10–20 minutes and the positive feedback on the online version suggest that the German GOAL-LD™ is feasible for use in both research and clinical contexts.

Similar experiences have been reported in other translation studies of PROMs in limb deformity and reconstructive surgery, such as the Limb Deformity-Scoliosis Research Society (LD-SRS) and LIMB-Q Kids, where careful wording and age-appropriate phrasing were key to achieving good comprehensibility [16, 17].

During the translational process, several challenges were encountered. Some terms in the original English version did not have a direct equivalent in German, or there were multiple possible translations conveying slightly different nuances. These challenges underscore the importance of a structured adaptation process. Consistent with established guidance for PROMs translation, repeated reconciliation meetings and iterative review were essential for achieving conceptual equivalence [13]. Following these guidelines, several other research groups have also demonstrated successful translation and validation of PROMs [17–21].

The psychometric results of this study provide initial support for the reliability of the German GOAL-LD™ in this sample. Internal consistency was excellent for the total score (α = 0.91) and acceptable to excellent across most domains, which is broadly in agreement with the reliability coefficients reported for the original English version [11]. The pattern of corrected item–total correlations, with a mean of 0.49 ± 0.21, indicates moderate item–scale coherence and some heterogeneity across items, which is not unexpected for a multidomain instrument capturing functional, psychosocial, and participatory dimensions. The lowest internal consistency was observed in the Pain/Discomfort/Fatigue domain (α = 0.64), accompanied by a pronounced ceiling effect (48.6%). This is likely a reflection of the functional status of the sample, as many participants were at the end of treatment or had already regained high levels of daily functioning. Similar limitations in score variability and related effects on reliability have been described in other PROMs studies involving well-functioning patients with LDs or after reconstructive procedures [22–24]. Importantly, no ceiling effect was found for the total GOAL-LD™ score, suggesting that the instrument as a whole can still differentiate between different levels of outcome in this patient group.

Principal component analysis supported the multidimensional structure of the German GOAL-LD™, with items loading predominantly on their expected domains and minimal cross-loadings. This indicates that the intended conceptual structure of the instrument was preserved through the translation and adaptation process and is consistent with the domain structure reported in the original validation [11]. Nevertheless, the relatively small sample size in this study limits the stability of factor-analytic results, and these findings should therefore be regarded as preliminary. Comparable translation and adaptation studies have also reported initial structural support in smaller samples, with more extensive psychometric testing carried out in subsequent, larger cohorts [25–27].

PROMs, such as the paediatric Toronto Extremity Salvage Score (pTESS), which was developed to assess functional abilities and everyday performance in children and adolescents following limb salvage surgery, amputation, or reconstruction, focus especially on physical function [28]. In contrast, the GOAL-LD™ represents a more comprehensive and multidimensional instrument. While it also evaluates physical function, the GOAL-LD™ extends beyond daily activities by incorporating psychosocial and participatory dimensions [10].

The proper validation of PROMs is essential to ensure reliable outcome assessment and to strengthen their role in evidence-based treatment planning and research as they are increasingly used to support

clinical decision-making and to identify which treatments actually lead to long-term improvements [29]. Many studies continue to employ instruments that have not been fully validated for the specific paediatric populations under investigation [30]. In many cases, validation was incomplete because PROMs had either been validated only in adult populations or were considered unsuitable for use in children, whereas GOAL-LD™ was explicitly designed for use in paediatric populations [10, 30].

Additionally, several studies indicate that routine use of PROMs in paediatric clinical care can identify emerging symptoms and functional declines that might otherwise go undetected, thereby facilitating early clinical intervention [31–33]. Long-term patient follow-up allows important treatment adjustments throughout the course of care and promotes enhanced communication and informed decision-making with families [34, 35]. This is particularly important for patients with LDs, as their conditions are often growth-dependent, requiring prolonged treatment, and making early identification of emerging problems essential for timely intervention. Therefore, the GOAL-LD™ represents a significant opportunity to improve monitoring and timely clinical decision-making.

This study has several limitations. The sample size was small and drawn from a single centre, which restricts the generalisability of the findings and limits the precision of psychometric estimates. The factor-analytic results should be interpreted with caution and regarded as exploratory rather than confirmatory. Furthermore, this study focused on translation, cultural adaptation, feasibility, and internal consistency; other measurement properties such as test–retest reliability, responsiveness to clinical change, and relationships with external constructs were not examined and should be addressed in future work. All cognitive interviews were conducted by a single investigator, which ensured consistent administration but may have introduced interviewer-related influence. Finally, some younger participants showed decreased attention towards the end of the questionnaire, suggesting that additional support or breaks may be helpful for this age group when implementing the instrument in routine care.

Since PROMs typically capture only a single dimension, combining multiple PROMs is advisable to obtain a comprehensive assessment of patient status [9, 36, 37]. This is especially important in paediatric populations with LDs, as using multiple PROMs across the trajectory - from diagnosis, through therapy, to post-therapy follow-up – enables optimal monitoring, guides therapeutic decision-making, and supports the best possible treatment outcomes. While the GOAL-LD™ provides targeted measurement of gait-related outcomes and psychosocial dimensions for children with LDs, the use of a generic instrument such as the Pediatric Quality of Life Inventory (PedsQL) or Patient-Reported Outcomes Measurement Information System (PROMIS) concurrently allows for benchmarking against broad HRQoL constructs and normative populations. On their own, these generic measures are unlikely to adequately capture items or domains of importance to patients with LD. However, the combined application might enhance both content-specific sensitivity and external comparability [38, 39].

Conclusion

The German version of the GOAL-LD™ was established through a structured translation and cross-cultural adaptation process and demonstrated high comprehensibility, feasibility, and favourable initial psychometric properties in children and adolescents with LDs. The instrument preserves the multidimensional framework of the original version and enables standardised assessment of functional, psychosocial, and participation-related outcomes in German-speaking clinical and research settings. It can be used for children between the ages of 9 and 18 years and may support improved communication regarding needs and perspectives among parents, children, and healthcare professionals.

Statements and Declarations

Funding

The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

Ethics Approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee Westfalen-Lippe, Germany (date: September 6th, 2021; registration number: 2021-556-fS).

Consent to participate

Written informed consent was obtained from the parents or legal guardians, and all children included in the study gave their verbal assent.

Consent to publish

The authors affirm that human research participants provided informed consent for publication.

References

1. Chhina H, Klassen AF, Kopec JA, Oliffe J, Iobst C, Dahan-Oliel N, Cooper AP (2021) What matters to children with lower limb deformities: an international qualitative study guiding the development of a new patient-reported outcome measure. J Patient-Reported Outcomes 5(1). https://doi.org/10.1186/s41687-021-00299-w
2. Farr A, Wachutka E, Bettelheim D, Windsperger K, Farr S (2020) Perinatal outcomes of infants with congenital limb malformations: An observational study from a tertiary referral center in Central Europe. BMC Pregnancy Childbirth 20(1). https://doi.org/10.1186/s12884-020-2720-x
3. Ganeb SS, Egaila SES, Younis AA, El-Aziz AMA, Hashaad NI (2021) Prevalence of lower limb deformities among primary school students. Egypt Rheumatol Rehabilitation 48(1). https://doi.org/10.1186/s43166-021-00082-1

4. Brzeziński M, Czubek Z, Niedzielska A, Jankowski M, Kobus T, Ossowski Z (2019) Relationship between lower-extremity defects and body mass among polish children: A cross-sectional study. BMC Musculoskelet Disord 20(1). https://doi.org/10.1186/s12891-019-2460-0
5. Heath MR, Shin TJ, Mehta R, Principe PS, MacKie AT, Fragomen A, Fabricant PD (2021) Patients With Lower Limb Deformity Report Worse Quality of Life Than Control Subjects Regardless of Degree of Deformity. J Am Acad Orthop Surg Global Res Reviews 5(8). https://doi.org/10.5435/JAAOSGlobal-D-21-00182
6. Hubbard EW, Cherkashin A, Samchukov M, Podeszwa D (2023) The Evolution of Guided Growth for Lower Extremity Angular Correction. J Pediatr Orthop Soc North Am 5(3). https://doi.org/10.55275/jposna-2023-738
7. Kitoh H, Kamiya Y, Mishima K, Matsushita M, Kaneko H, Kitamura A, Matsuyama S (2023) Guided growth for coronal lower limb deformities in skeletal dysplasia. J Pediatr Orthop Part B 32(2). https://doi.org/10.1097/BPB.0000000000000965
8. Vogt B, Gosheger G, Wirth T, Horn J, Rödl R (2020) Leg Length Discrepancy— Treatment Indications and Strategies. Deutsches Ärzteblatt international. https://doi.org/10.3238/arztebl.2020.0405
9. Churruca K, Pomare C, Ellis LA, Long JC, Henderson SB, Murphy LED, Braithwaite J (2021), August 1 Patient-reported outcome measures (PROMs): A review of generic and condition-specific measures and a discussion of trends and issues. *Health Expectations*. John Wiley and Sons Inc. https://doi.org/10.1111/hex.13254
10. Dermott JA, Wright FV, Salbach NM, Narayanan UG (2021) Development of the gait outcomes assessment list for lower-limb differences (GOAL-LD) questionnaire: a child and parent reported outcome measure. Health Qual Life Outcomes 19(1). https://doi.org/10.1186/s12955-021-01775-z
11. Griffiths AL, Donnan LT, Iobst CA, Kelley SP, Bouchard M, Narayanan UG (2021) The Gait Outcomes Assessment List for Children with Lower Limb Difference (GOAL-LD): Assessment of Reliability and Validity. J Pediatr Orthop 41(7). https://doi.org/10.1097/BPO.0000000000001866
12. Program PSCORE *Translation Guidelines*. Toronto: The Hospital for Sick Children; n.d. Available from: https://lab.sickkids.ca/pscoreprogram/wp-content/uploads/sites/72/2017/12/Translation-Guidelines.pdf
13. Wild D, Grove A, Martin M, Eremenco S, McElroy S, Verjee-Lorenz A, Erikson P (2005) Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) measures: Report of the ISPOR Task Force for Translation and Cultural Adaptation. Value Health 8(2):94–104. https://doi.org/10.1111/j.1524-4733.2005.04054.x
14. Taber KS (2018) The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. Res Sci Educ 48(6):1273–1296. https://doi.org/10.1007/s11165-016-9602-2
15. Koenig KD, Hall MJ, Gormley C, Kaleta M, Munger M, Laine J, Morgan SJ (2024), June 26 Clinical outcomes measurement in pediatric lower limb prosthetics: A scoping review. *Journal of Pediatric Rehabilitation Medicine*. IOS Press BV. https://doi.org/10.3233/PRM-230014

16. Brune CS, Toporowski G, Rölfing JD, Gosheger G, Fresen J, Frommer A, Vogt B (2022) German Translation and Cross-Cultural Adaptation of the Limb Deformity-Scoliosis Research Society (LD-SRS) Questionnaire. Healthc (Switzerland) 10(7). https://doi.org/10.3390/healthcare10071299
17. Vogt B, Fresen J, Gosheger G, Chhina H, Brune CS, Toporowski G, Rölfing JD (2022) LIMB-Q Kids—German Translation and Cultural Adaptation. Children 9(9). https://doi.org/10.3390/children9091405
18. Janik PE, Opyrchał J, Ambroziak M, Noszczyk B, Paul MA (2024) Polish Translation and Linguistic Validation of the SCAR-Q. Cureus. https://doi.org/10.7759/cureus.52848
19. Nicolas-Boluda A, Simon S (2023) Validation of the French version of the ICHOM adult oral health standard set. Clin Experimental Dent Res. https://doi.org/10.1002/cre2.682
20. Kuiper SZ, Kimman ML, Cooper R, O'Neill H, Watson AJM, Melenhorst J, Dirksen CD (2023) English translation and cross-cultural validation of the patient-reported outcome measurement-haemorrhoidal impact and satisfaction score (PROM-HISS). Colorectal Dis 25(8). https://doi.org/10.1111/codi.16650
21. Lin YS, Tai HC, Huang CS (2024) Culturally adapted translation of LYMPH-Q upper extremity module from English to Mandarin Chinese. J Formos Med Assoc 123(9). https://doi.org/10.1016/j.jfma.2024.01.010
22. Deng W, Shao H, Zhou Y, Li H, Wang Z, Huang Y (2022) Reliability and validity of commonly used patient-reported outcome measures (PROMs) after medial unicompartmental knee arthroplasty. Orthop Traumatology: Surg Res 108(8). https://doi.org/10.1016/j.otsr.2021.103096
23. Eckhard L, Munir S, Wood D, Talbot S, Brighton R, Walter B, Baré J (2021) The ceiling effects of patient reported outcome measures for total knee arthroplasty. Orthop Traumatology: Surg Res 107(3). https://doi.org/10.1016/j.otsr.2020.102758
24. Gulledge CM, Lizzio VA, Smith DG, Guo E, Makhni EC (2020), March 1 What Are the Floor and Ceiling Effects of Patient-Reported Outcomes Measurement Information System Computer Adaptive Test Domains in Orthopaedic Patients? A Systematic Review. *Arthroscopy - Journal of Arthroscopic and Related Surgery*. W.B. Saunders. https://doi.org/10.1016/j.arthro.2019.09.022
25. Pakdel FK, Pakdel AK, Norasteh AA (2025) Cross-cultural adaptation and validation of the 12-item short forms of the knee injury and osteoarthritis outcome score (KOOS-12) to Persian language. J Orthop Surg Res 20(1). https://doi.org/10.1186/s13018-025-06301-1
26. Gökşen A, Çaylak R, Kübra Çekok F, Kahraman T (2024) Translation, cross-cultural adaptation, reliability, and convergent and known-group validity of the Turkish full version of the Hip Disability and Osteoarthritis Outcome Score in patients with hip osteoarthritis. Archives Rheumatol 39(2):180–193. https://doi.org/10.46497/ArchRheumatol.2024.10197
27. Zhang Y, Ren J, Zang Y, Guo W, Disantis A, Martin RL (2023) Cross-Culturally Adapted Versions of Patient Reported Outcome Measures for the Lower Extremity. Int J Sports Phys Therapy 18(3):653–686. https://doi.org/10.26603/001c.74528

28. Piscione J, Barden W, Barry J, Malkin A, Roy T, Sueyoshi T, Hopyan S (2019) The Pediatric Toronto Extremity Salvage Score (pTESS): Validation of a Self-reported Functional Outcomes Tool for Children with Extremity Tumors. Clin Orthop Relat Res 477(9). https://doi.org/10.1097/CORR.0000000000000756
29. Kunze KN, Madjarova S, Jayakumar P, Nwachukwu BU (2023), October 15 Challenges and Opportunities for the Use of Patient-Reported Outcome Measures in Orthopaedic Pediatric and Sports Medicine Surgery. *Journal of the American Academy of Orthopaedic Surgeons*. Lippincott Williams and Wilkins. https://doi.org/10.5435/JAAOS-D-23-00087
30. Arguelles GR, Shin M, Lebrun DG, Kocher MS, Baldwin KD, Patel NM (2021) The Majority of Patient-reported Outcome Measures in Pediatric Orthopaedic Research Are Used without Validation. J Pediatr Orthop 41(1):e74–e79. https://doi.org/10.1097/BPO.0000000000001659
31. Mohr M, McClure PK, Nowlan NC, Green CJ (2025), November 1 Patient-reported Outcome Measures in Pediatric Orthopaedics. *Journal of the Pediatric Orthopaedic Society of North America*. Elsevier B.V. https://doi.org/10.1016/j.jposna.2025.100270
32. Meryk, A., Kropshofer, G., Hetzer, B., Riedl, D., Lehmann, J., Rumpold, G., … Crazzolara,R. (2022). Use of Daily Patient-Reported Outcome Measurements in Pediatric Cancer Care. *JAMA Network Open*, *5*(7), e2223701. https://doi.org/10.1001/jamanetworkopen.2022.23701
33. Bele S, Santana MJ (2025) Patient-reported outcome measures to deliver patient and family-centered care in pediatrics: the ball is now in our court. *Frontiers in Health Services*, *5*. https://doi.org/10.3389/frhs.2025.1529731
34. Morris, E. J., Gray, K., Gibbons, P. J., Grayson, J., Sullivan, J., Amorim, A. B.,… McKay, M. J. (2023, September 1). Evaluating the Use of PROMs in Paediatric Orthopaedic Registries. *Children*. Multidisciplinary Digital Publishing Institute (MDPI). https://doi.org/10.3390/children10091552
35. Charla, J. N., Mehraban Alvandi, L., Samuel, Z., Ishag, C., Warner, T., Hailer, Y.D., … Fornari, E. D. (2025). Longitudinal Evaluation of Patient-reported Outcomes Measurement Information System (PROMIS) Scores in Children Under 6 With Legg-Calvé-Perthes Disease: A Multicenter Study. *Journal of Pediatric Orthopaedics*. https://doi.org/10.1097/BPO.0000000000003053
36. Snowdon DA, Srikanth V, Beare R, Marsh L, Parker E, Naude K, Andrew NE (2023) A landscape assessment of the use of patient reported outcome measures in research, quality improvement and clinical care across a healthcare organisation. BMC Health Serv Res 23(1). https://doi.org/10.1186/s12913-023-09050-1
37. Al Sayah F, Jin X, Johnson JA (2021) Selection of patient-reported outcome measures (PROMs) for use in health systems. *Journal of Patient-Reported Outcomes*, *5*. https://doi.org/10.1186/s41687-021-00374-2
38. Varni JW, Seid M, Rode CA (1999) The PedsQL™: Measurement model for the pediatric quality of life inventory. Med Care 37(2). https://doi.org/10.1097/00005650-199902000-00003
39. Lapin B, Katzan IL (2023) PROMIS global health: potential utility as a screener to trigger construct-specific patient-reported outcome measures in clinical care. Qual Life Res 32(1).

https://doi.org/10.1007/s11136-022-03206-y

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- GOALLD3.0ChildGerman.pdf
- GOALLD3.0ParentGerman.pdf
- SupplementaryMaterialTableS1.docx