Validity Assessment of the Swiss Orthopaedics Minimal Data Set compared to the subjective shoulder value for rotator cuff repair in relation to Constant score

Daniel Felbar [1], **Vilijam Zdravkovic** [1] **(*)**, **Andreas Mueller** [2], **Laurent Audigé** [3 4], **Alexandre Lädermann** [5 6 7 8], **Claudio Rosso** [9], **ARCR_Pred Study Group** [10], **Bernhard Jost** [1]

(*) corresponding author: Vilijam.Zdravkovic@kssg.ch
1. Clinic for Orthopaedic Surgery and Traumatology of the Musculoskeletal system, Cantonal Hospital St. Gallen, St. Gallen, Switzerland
2. Orthopaedic Surgery and Traumatology, University Hospital of Basel, Basel, Switzerland
3. Research and Development Department, Schulthess Klinik, Zurich, Switzerland
4. Surgical Outcome Research Center, University Hospital Basel, University of Basel, Basel, Switzerland
5. Division of Orthopaedics and Trauma Surgery, Hôpital de La Tour, Rue J.-D. Maillard 3, 1217 Meyrin, Switzerland
6. Division of Orthopaedics and Trauma Surgery, Department of Surgery, Geneva University Hospitals, Rue Gabrielle-Perret-Gentil 4, CH-1211 Geneva 14, Switzerland
7. Faculty of Medicine, University of Geneva, Rue Michel-Servet 1, 1211 Geneva 4, Switzerland
8. FORE (Foundation for Research and Teaching in Orthopedics, Sports Medicine, Trauma, and Imaging in the Musculoskeletal System), Avenue J.-D. Maillard 3, 1217 Meyrin, Switzerland
9. Shoulder and Elbow Center, ARTHRO Medics, Basel, Switzerland
10. The complete list of authors can be found in the disclaimer

Background: Despite numerous Patient Reported Outcome Measures (PROMs) in shoulder surgery, no standard has been established for subjective measurement of shoulder outcomes.

Purpose: This study examines the validity of the Swiss Orthopaedics Minimal Data Set (SOMDS) compared to the subjective shoulder value (SSV) for shoulder pathology in relation to Constant score in patients undergoing arthroscopic rotator cuff reconstruction.

Methods: As part of the ARCR_Pred Cohort Study, 973 patients undergoing arthroscopic rotator cuff reconstruction were included from June 2020 to November 2021 across 19 centers. Follow-up examinations at 12 months postoperatively assessed the Constant score, the SOMDS, the subjective shoulder value (SSV), and the EQ-5D-5L index. The validity of both the SOMDS and the SSV was evaluated in comparison to the Constant score, using Cronbach's alpha for consistency and correlation analyses for validity. Results were visualized with boxplots to assess ceiling effect.

Results: The SOMDS has a Cronbach's alpha of $\alpha = 0.56$. Excluding the level of education sub-item improves internal consistency to $\alpha = 0.64$. A linear regression model shows a strong correlation between the SOMDS and Constant score ($r = 0.657$, $p < 0.001$), superior to the EQ-5D-5L index ($r = 0.657$ vs. 0.562, $p = 0.002$) and comparable to the SSV ($r = 0.657$ vs. 0.644, $p = 0.644$). Sub-item correlations were also highly significant ($p < 0.001$). Boxplot analysis reveals a more pronounced ceiling effect for the SOMDS compared to the Constant score and the SSV, particularly affecting the joint-specific satisfaction sub-item.

Conclusion: The SOMDS is a time-saving alternative to the Constant score, with a comparable validity to but higher ceiling effect than the SSV. SOMDS and SSV are useful depending on the parameters required to be recorded in everyday clinical practice or for study needs: SSV for patient-perceived functionality and SOMDS for broader assessment of health dimensions. The SOMDS without the level of education sub-item has improved internal consistency.

What this study adds: The SOMDS is a valid tool for shoulder outcome assessment.

How this study might affect research, practice or policy: Standardizing shoulder outcome measures using the SSV for patient-perceived functionality and the SOMDS for a broader evaluation of health dimensions.

Study Design: prospective cohort study

Level of evidence: Level II

Keywords: Shoulder; Rotator cuff repair; ARCR_Pred Cohort Study, Patient reported outcome measures (PROMs), Complications; Scores; Postoperative evaluation.

https://doi.org/10.70885/hmsj.2025.05.002

Introduction

Patient Related Outcome Measures (PROMs) are increasingly being used to assess treatment outcomes in orthopedic shoulder surgery [1][2]. Evaluating clinical outcomes is crucial not only to assess the effectiveness of treatments and tailor rehabilitation programs but also to enhance patient education and encourage long-term engagement in their own care. By capturing patients' subjective perceptions, PROMs facilitate a more individualized and patient-centered assessment of therapeutic efficacy [3]. One of them, the Swiss Orthopaedics Minimal Data Set (SOMDS), enables comprehensive recording of post-interventional results for all body regions of the musculoskeletal system [4].

Most scoring systems consist of multi-item questionnaires that combine both subjective and objective elements. Despite the valuable and detailed insights these questionnaires provide, they are often lengthy and complex, making them challenging for patients to comprehend. This complexity can result in inefficient clinical processes, patient frustration, and incomplete forms [5]. Moreover, PROMs rely on patients' subjective impressions, which increases susceptibility to bias and can potentially lead to inaccuracies in the reported results [6][7].

The aim of this study was to examine the validity of the SOMDS compared to the Constant score and subjective shoulder value (SSV) in patients undergoing arthroscopic rotator cuff reconstruction. The hypothesis was that SOMDS would provide a time-saving alternative to the Constant score with at least similar validity, and even better validity compared to the SSV with its broader assessment of health dimensions.

Methods

Study design

As part of the ARCR_Pred Cohort Study (Swiss-wide multicenter evaluation and prediction of core outcomes in arthroscopic rotator cuff repair), a cohort of 973 patients with arthroscopic reconstruction of the rotator cuff was prospectively recorded in 18 Swiss and one German orthopedic center between June 2020 and November 2021 and followed up for 24 months postoperatively.

Eligibility criteria

Included were adults with partial or complete rotator cuff tears diagnosed by MRI and scheduled for primary arthroscopic repair. Patients with irreparable tears undergoing specialised procedures such as tendon transfer or capsular reconstruction, revision procedures, open or mini-open reconstructions are excluded. Also excluded are persons without written consent, without the possibility of follow-up care, without language skills in German, French, Italian or English and pregnant women.

Institutional Review Board and trial registration

The study was conducted according to the Declaration of Helsinki principles, was approved prior to beginning by the lead ethics committee (EKNZ, Basel, Switzerland; ARCR_Pred Cohort Study ID: 2019-02076, ClinicalTrial.gov registration number of the ARCR_Pred cohort study is NCT04321005) [8]. All patients provided written informed consent for the use of their data for research purposes.

Data source and extracted data

The data set of the ARCR_Pred cohort study serves as the data basis. The study data were managed using the REDCap electronic data capture system and are exported for variable transformation (including score calculations) and statistical analysis [9]. For statistical analysis, the Constant score and SSV variables, as well as the EQ-5D-5L index, joint-specific pain, joint-specific satisfaction and level of education were extracted to calculate the SOMDS. These variables were considered at the 12-month follow-up.

Equity, Diversity and Inclusion Statement

The studied population included women and men of all ethnicities, reflecting the usual distribution for this pathology. Additionally, the cohort represented a wide range of ages, backgrounds, and demographics. The ARCR_Pred Study Group comprised 973 women and men at different stages of their careers and clinical disciplines.

Study Variables

Functional and structural results, as well as PROMs and adverse events were recorded at the 6-week, 6-, 12-, and 24-month follow-up. Clinical examinations at baseline, 6, and 12 months included assessment of shoulder pain, range of motion and strength using the Constant score [8].

Constant score

The Constant score is a 100-point scale for assessing pain and functionality in shoulder pathologies. It consists of four subscales: pain (15 points), activities of daily living (20 points), strength (25 points) and shoulder range of motion (40 points) [10]. Its reliance on objective criteria presents practical challenges in clinical settings. Measuring wrist strength at 90° abduction in the shoulder joint and recording shoulder mobility are time-consuming and require the availability of appropriate equipment [11].

SOMDS

The SOMDS is an attempt to establish a standardized PROM in shoulder pathologies for use primarily in Switzerland. The SOMDS is based on the European Quality of Life 5 Dimensions 5 Level Version (EQ-5D-5L) questionnaire, which measures the dimensions of: Agility/mobility, self-care, activities of daily living, pain/physical discomfort and anxiety/depression. Each dimension is assessed on five levels, with level 1 representing no problems and level 5 representing extreme problems. The resulting 5-digit number is converted into an index between -0.59 to 1, where 1 is the best possible health state [12]. In addition to these dimensions, the SOMDS incorporates several other measures: joint-specific pain in the last week (scale from 0 = no pain to 10 = most severe pain), joint-specific satisfaction (scale from 1 = very dissatisfied to 5 = very satisfied) and level of education (up to 9 years of education = compulsory education; 10-13 years of education = vocational education/ upper secondary school; more than 13 years of education = university/ college of higher education) (**Table 1**). The interpretation relies on a rating scale for each individual item rather than a singular composite index value [13].

Table 1. Swiss Orthopaedics Minimal Data Set (SOMDS).

Dimension	Rating Scale
Agility/Mobility	O Level 1: No problems O Level 2: Slight problems O Level 3: Moderate problems O Level 4: Severe problems O Level 5: Unable/extreme problems
Self-care	O Level 1: No problems O Level 2: Slight problems O Level 3: Moderate problems O Level 4: Severe problems O Level 5: Unable/extreme problems
Activities of daily living	O Level 1: No problems O Level 2: Slight problems O Level 3: Moderate problems O Level 4: Severe problems O Level 5: Unable/extreme problems
Pain/Physical discomfort	O Level 1: No problems O Level 2: Slight problems O Level 3: Moderate problems O Level 4: Severe problems O Level 5: Unable/extreme problems
Anxiety/Depression	O Level 1: No problems O Level 2: Slight problems O Level 3: Moderate problems O Level 4: Severe problems O Level 5: Unable/extreme problems
Joint-specific pain (last week)	0 (no pain) - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 (most severe pain)
Joint-specific satisfaction	O 1 (very dissatisfied) O 2 (somewhat dissatisfied) O 3 (neutral) O 4 (somewhat satisfied) O 5 (very satisfied)
Level of education	O Up to 9 years (compulsory education) O 10-13 years (vocational education/upper secondary school) O More than 13 years (university/college of higher education)

SSV

The SSV is a simple PROM, evaluating shoulder functionality on a scale from 0% (unusable) to 100% (completely healthy) in 5% increments [14] [15]. The main advantage of this univariate score is the rapid assessment of shoulder functionality [16].

Statistical analysis

The statistical methodology is designed to analyze both the internal consistency, reliability and validity of the SOMDS compared to the Constant score and the SSV. All SOMDS variables were standardized on a scale from 0 to 1. The pain variable was inverted so that higher pain scores corresponded to lower normalized scores. This allowed the calculation of an average SOMDS score ranging from 0 (worst) to 1 (best). Cronbach's alpha was computed for the SOMDS and its sub-items, evaluating internal consistency and guiding decisions on whether to include or exclude specific sub-items. Pearson's correlation coefficient was used to investigate the relationship and validity between the SOMDS, including its sub-items, the Constant score and the SSV. The Fisher-Z-test was used to calculate the correlation difference between SOMDS and SSV in relation to the Constant score. Statistical significance was set at a p-value < 0.05. To visualize the distribution and assess the ceiling effect, results of the Constant score, the SOMDS with its sub-items and the SSV were depicted as boxplots. The statistical analysis was performed with R [17].

Results

Internal consistency

The SOMDS demonstrates moderate internal consistency with a raw value of Cronbach's alpha of α = 0.56 (standard alpha = 0.66). Further analysis revealed that excluding the level of education sub-item could enhance it to raw α = 0.64 (standard alpha = 0.73). (**Table 2**) The level of education variable was therefore excluded from the SOMDS for the following analyses.

Validity analysis

A strong correlation between the SOMDS and the Constant score, r = 0.657 (p < 0.001, **Figure 1**) was observed. The individual sub-items of the SOMDS also demonstrated highly significant correlations independently (p < 0.001). In comparison, the SOMDS exhibited a notably superior correlation to the Constant score compared to the EQ-5D-5L index (r = 0.657 vs. 0.562, p = 0.002), and a comparable correlation to the SSV (r = 0.657 vs. 0.644, p = 0.644) (**Table 3**).

Data distribution and ceiling effect

The box plot visualization (**Figure 2**) illustrates the data distribution, highlighting a higher proportion of patients reaching the maximum score for the SOMDS (especially pronounced for the joint-specific satisfaction variable) and EQ-5D-5L index twelve months post-intervention compared to the Constant score and SSV. The EQ-5D-5L index had the highest proportion, with 39.73% (348 patients) achieving the maximum score, followed by the SOMDS at 28.96% (247 patients) and the SSV at 14.17% (124 patients). No patient reached the maximum score on the Constant score.

Table 2. Internal consistency of the Swiss Orthopaedics Minimal Data Set (SOMDS) if a sub-item was dropped.

sub-item	raw alpha	standard alpha
joint-specific satisfaction	0,45	0,57
level of education	0,64	0,73
joint-specific pain	0,42	0,53
eq5d5l	0,47	0,52

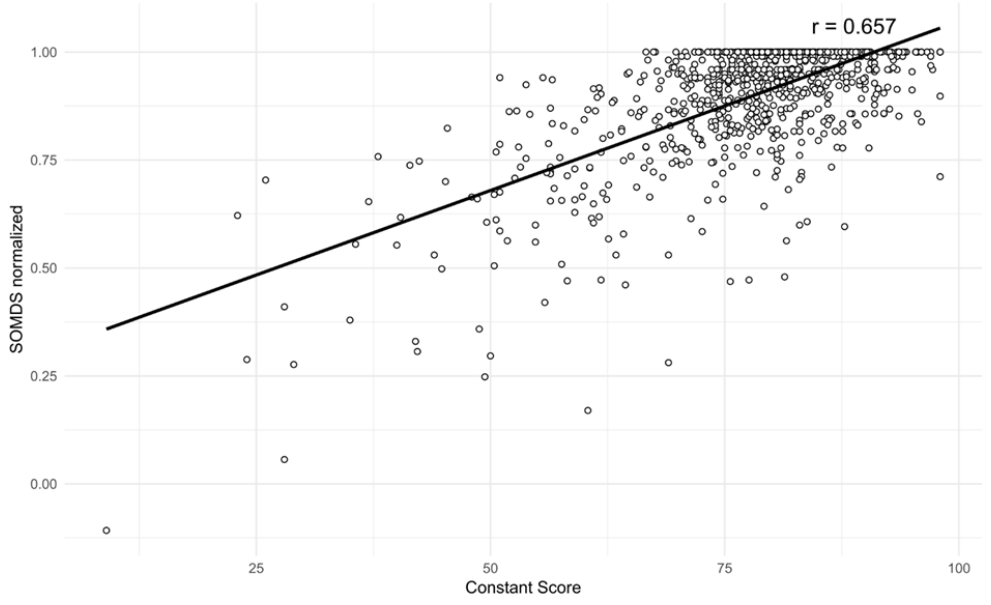


Figure 1. Linear regression relation between the Swiss Orthopaedics Minimal Data Set (SOMDS) and Constant score.

Table 3. Intercorrelation of the SOMDS with its sub-items, the SSV, and the Constant score.

independent variable	dependent variable	correlation	p-value	CI-lower	CI-upper
Constant Score	SOMDS	0,657	p<0,001	0,617	0,694
Constant Score	joint-specific satisfaction	0,422	p<0,001	0,364	0,476
Constant Score	joint-specific pain	0,651	p<0,001	0,610	0,688
Constant Score	eq5d5l index	0,562	p<0,001	0,514	0,606
Constant Score	subjective shoulder value	0,644	p<0,001	0,603	0,682
SOMDS	eq5d5l index	0,929	p<0,001	0,920	0,938
SOMDS	subjective shoulder value	0,698	p<0,001	0,662	0,731

Discussion

In recent years, there has been a notable shift towards the progressive adoption of PROMs for evaluating outcomes in orthopedic shoulder surgery [1]. However, gathering scores from multi-item assessments can be difficult as it may encroach on valuable consultation time or result in incomplete or unfilled forms when self-reported, often due to patient frustration, misunderstanding, or simple forgetfulness. Thus, an optimal scoring system should be straightforward, well-received, and easy to administer, requiring minimal resources and time. The present study showed that the SOMDS offers a time-saving alternative to the Constant score, confirming our hypothesis. However, its validity is, despite broader assessment of health dimensions, comparable to the SSV.

The SOMDS and SSV have emerged as robust alternatives to the Constant score for assessing rotator cuff repairs in routine clinical practice. Similar studies have already demonstrated that the SSV [18] and SSV instability [16] are valuable substitutes for the American Shoulder and Elbow Surgeons (ASES) score and the Rowe score, specifically in evaluating rotator cuff or superior labrum anterior to posterior (SLAP) repairs and glenohumeral instability, respectively. SSV ease of use and efficiency in recording outcomes make it a practical PROM. The choice of PROM should align with the study's objectives: instruments like SSV effectively capture patient-perceived functionality, whereas SOMDS provides a broader scope of mobility, self-care, activities, pain, and anxiety, SOMDS thus complement shoulder function scores by addressing broader health dimensions. Although time to document remains underexplored, SSV's single-question format proves advantageous for minimizing administrative burden without compromising on outcome insights [16], suggesting its utility in clinical practice and remote monitoring.

Despite robust evidence supporting the internal consistency, reliability and structural validity of these scores, a universally accepted standard has yet to emerge due to the lack of high- quality studies, as well as country and surgeon-related preferences [19][20]. Additionally, the Constant score, which is often regarded as the gold standard and frequently used for comparative analyses, has different evidence for different shoulder pathologies. Although recommended for assessing shoulder instability, its applicability to other conditions, such as subacromial impingement, fractures, arthritis and frozen shoulder, remains less clear [21]. This underscores the ongoing challenge in establishing a single, universally applicable standard for shoulder outcome measurement.

Both the SOMDS and the EQ-5D-5L index exhibit a pronounced ceiling effect, where patients tend to assign high scores when reporting favorable treatment outcomes. This tendency can obscure distinctions between good and very good results, thereby complicating the differentiation of treatment effects. The Constant score and the SSV have a less pronounced ceiling effect. This characteristic is particularly valuable for clinical studies requiring precise differentiation of treatment outcomes. However, this may not be clinically significant if the primary goal is patient satisfaction. In routine clinical practice, if patients report high satisfaction and improved functionality, the treatment can be considered successful.

The analyses conducted – with exclusion of the level of education variable – revealed a notably superior correlation for the SOMDS compared to the EQ-5D-5L index. Since the EQ-5D-5L index is a component of the SOMDS, this suggests that the SOMDS is a valuable extension that provides more precise insights with just a few additional questions. Although patients' level of education correlates with treatment results in shoulder pathology [22], this sub-item is often perceived as unpleasant by patients in the case of repetitive queries. Additionally, since patients typically do not engage in new educational activities between their monthly follow-up visits, this sub-item lacks sensitivity in tracking temporal changes and thus does not contribute effectively to a score that is evaluated over time. Regarding also better internal consistency without this sub-item, the SOMDS can be used without the level of education variable.

Limitations

This study included patients from 19 centers in two countries. Differences in clinical practice, patient demographics and response tendencies may have influenced the results. Analyses were performed 12 months postoperatively and may not be transferable to other time points. Results of the SOMDS, which was converted to a single index score in this study, may not translate seamlessly into daily clinical practice. This is because the SOMDS, which also incorporates non-numeric variables, is currently not designed as a score. Its interpretation is - contrary to our approach - based on a rating scale for each individual item rather than a consolidated index. Efficient score calculations will likely require a software interface in the future. Finally, we do not know if the difference in ceiling effect between SOMDS and SSV is clinically relevant.

Conclusions

The SOMDS is a time-saving alternative to the Constant score, with a comparable validity to but higher ceiling effect than the SSV. SOMDS and SSV are useful depending on the parameters required to be recorded in everyday clinical practice or for study needs: SSV for patient-perceived functionality and SOMDS for broader assessment of health dimensions. The SOMDS without the level of education sub-item has improved internal consistency.

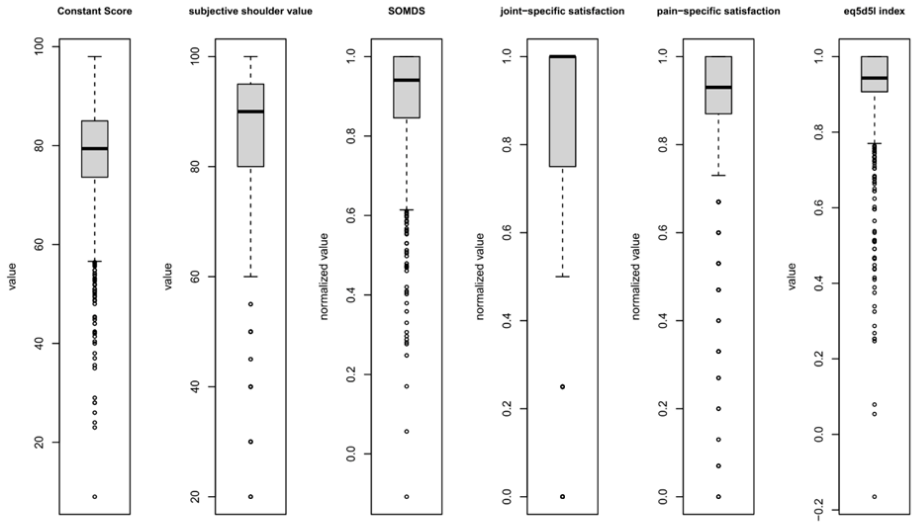


Figure 2. Data distribution of the SOMDS with its sub-items, the SSV and the Constant score.

Open access statement

This is an open-access article distributed under the terms of the Creative Commons Attribution Licence for Commercial and Non-Commercial Purposes (**CC BY 4.0**, see https://creativecommons.org/licenses/by/4.0/), which allows free use, distribution, adaptation, and commercial use of a work, provided proper credit is given to the creator.

Complete list of authors

Members of the ARCR_Pred Study Group are listed below per site and partner institution: **ARTHRO Medics, Basel, CH (ART):** Claudio Rosso (Principal Investigator [PI]); **Charitè Medicine University, Berlin, DE (BER):** Philipp Moroder (PI), Doruk Akgün, Isabella Weiss, Eduardo Samaniego; **Cantonal Hospital Baselland, Bruderholz, CH (BRU):** Thomas Suter (PI), Sebastian A. Müller, Markus Saner, Claudia Haag-Schumacher; **Public Hospital Solothurn, Solothurn, CH (BSS):** Mai Lan Dao Trong (PI), Carlos Buitrago-Tellez, Julian Hasler, Ulf Riede; **Hôpital du Valais –Centre Hospitalier du Valais Romand, Martigny, CH (CHV):** Beat Moor (PI), Matthias Biner, Nicolas Gallusser; **Endoclinic, Zurich, CH (END):** Christoph Spormann (PI), Britta Hansen; **Klinik Gut, St Moritz, CH (GUT):** Holger Durchholz (PI); **Hirslanden Clinique la Colline, Geneva, CH (HIR):** Gregory Cunningham (PI); **La Tour Hospital, Meyrin, CH (HUG):** Alexandre Lädermann (PI); **Inselspital, Bern, CH (INB):** Michael Schär (PI), Rainer Egli, Stephanie Erdbrink, Kate Gerber, Paolo Lombardo, Johannes Weihs; **In-Motion, Wallisellen, CH (INM):** Matthias Flury (PI), Ralph Berther, Christine Ehrmann, Larissa Hübscher; **Institute of Social and Preventive Medicine (ISPM), University Bern, Bern, CH:** David Schwappach; **Cantonal Hospital Baden, Baden, CH (KSB):** Karim Eid (PI), Susanne Bensler, Yannick Fritz; **Cantonal Hospital Winterthur, Winterthur, CH (KSW):** Emanuel Benninger (PI), Philemon Grimm, Markus Pisan; **Schulthess Klinik, Zurich, CH (KWS):** Markus Scheibel (PI), Laurent Audigé, Daniela Brune, Marije de Jong, Stefan Diermayr, Marco Etter, Florian Freislederer, Michael Glanzmann, Cécile Grobet, Christian Jung, Fabrizio Moro, Ralph Ringer, Jan Schätz, Hans-Kaspar Schwyzer, Martina Wehrli, Barbara Wirth; **Ospedale Regionale di Lugano, Lugano, CH (LUG):** Christian Candrian (PI), Filippo Del Grande, Pietro Feltri, Giuseppe Filardo, Francesco Marbach, Florian Schönweger; **Cantonal Hospital St. Gallen, St. Gallen, CH (SGA):** Bernhard Jost (PI), Michael Badulescu, Stephanie Lüscher, Fabian Napieralski, Lena Öhrström, Martin Olach , Jan Rechsteiner, Jörg Scheler, Christian Spross, Vilijam Zdravkovic; **Orthopädie Sonnenhof, Bern, CH (SON):** Matthias A. Zumstein (PI), Annabel Hayoz, Julia Müller-Lebschi; **University Clinic Balgrist, Zurich, CH (UKB):** Karl Wieser (PI), Paul Borbas, Samy Bouaicha, Roland Camenzind, Sabrina Catanzaro, Christian Gerber, Florian Grubhofer, Anita Hasler, Bettina Hochreiter, Roy Marcus, Farah Selman, Reto Sutter, Sabine Wyss; **University Library Basel, University Basel, Basel, CH:** Christian Appenzeller-Herzog; **University Hospital Basel, Basel, CH (USB):** Andreas Marc Müller (PI), Soheila Aghlmandi, Cornelia Baum, Franziska Eckers, Kushtrim Grezda, Simone Hatz, Sabina Hunziker, Thomas Stojanov, Mohy Taha, Giorgio Tamborrini-Schütz.

Potential competing interests

All authors have completed and submitted the International Committee of Medical Journal Editors form for disclosure of potential conflicts of interest. No potential conflict of interest was disclosed.

Financial disclosure

The ARCR_Pred cohort study receives funding from the Swiss National Science Foundation (SNSF project ID 320030_184959, http://p3.snf.ch/project-184959). Additional funding was provided by Swiss Orthopedics for the documentation of the project sites and by the Swiss National Accident Insurance Fund (SUVA) for the performance of 12-month magnetic resonance imaging at selected sites. The following sites: Charité - Universitätsmedizin Berlin, Germany (BER); Bürgerspital Solothurn, Solothurn, Switzerland (BSS); Endoclinic, Zurich, Switzerland (END); Inselspital, Bern, Switzerland (INB); and Balgrist University Hospital, Zurich, Switzerland (UKB) - are funding their own participation in the ARCR_Pred cohort study.

References

1. Mosher, Zachary A., et al. "Usage trends of patient-reported outcome measures in shoulder literature." JAAOS-Journal of the American Academy of Orthopaedic Surgeons 28.17 (2020): e774-e781.
2. Lädermann, A., Eurin, R., Alibert, A., Bensouda, M., & Bothorel, H. (2021). Measuring patient value after total shoulder arthroplasty. Journal of Clinical Medicine, 10(23), 5700.
3. Meadows, Keith A. "Patient-reported outcome measures: an overview." British journal of community nursing 16.3 (2011): 146-151.
4. Jentzsch, Thorsten, et al. "Swiss Orthopaedics Minimal Dataset: First Pilot Report of Reliability and Validity." Advances in Orthopedics 2020 (2020): 1-4.
5. Cunningham, G., Zanchi, D., Emmert, K., Kopel, R., Van De Ville, D., Lädermann, A., & Hoffmeyer, P. (2015). Neural correlates of clinical scores in patients with anterior shoulder apprehension. Med Sci Sports Exerc, 47(12), 2612-2620.
6. Gagnier, Joel J., and Bradley C. Johnston. "Poor quality patient reported outcome measures bias effect estimates in orthopaedic randomized studies." Journal of Clinical Epidemiology 116 (2019): 36-38.
7. Zini, Michela Luciana Luisa, and Giuseppe Banfi. "A narrative literature review of bias in collecting patient reported outcomes measures (PROMs)." International journal of environmental research and public health 18.23 (2021): 12445.
8. Audigé, Laurent, et al. "Protocol: Swiss-wide multicentre evaluation and prediction of core outcomes in arthroscopic rotator cuff repair: protocol for the ARCR_Pred cohort study." BMJ Open 11.4 (2021).
9. Harris, Paul A., et al. "Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support." Journal of biomedical informatics 42.2 (2009): 377-381.
10. Constant, C. R., & Murley, A. G. (1987). A clinical method of functional assessment of the shoulder. Clinical Orthopaedics and Related Research®, 214, 160-164.

11. Lillkrona, U. (2008). How should we use the Constant Score?—A commentary. Journal of shoulder and elbow surgery, 17(2), 362-363.
12. Herdman, Michael, et al. "Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L)." Quality of life research 20 (2011): 1727-1736.
13. Jentzsch, T., Dora, C., Müller, U., & Farshad, M. (2020). Swiss orthopaedics minimal dataset: first pilot report of reliability and validity. Advances in Orthopedics, 2020(1), 6673175.
14. Gilbart, M. K., & Gerber, C. (2007). Comparison of the subjective shoulder value and the Constant score. Journal of shoulder and elbow surgery, 16(6), 717-721.
15. Pichonnaz C. et al. The subjective shoulder value: a valid and simple measurement tool for routine measure of shoulder function Introduction Methods. Retrieved from https://www.chuv.ch/fileadmin/sites/dso/documents/dso_2019_WCPT_
16. Lädermann, A., Denard, P. J., Collin, P., Ibrahim, M., Bothorel, H., & Chiu, J. C. H. (2021). Single Assessment Numeric Evaluation for instability as an alternative to the Rowe score. Journal of Shoulder and Elbow Surgery, 30(5), 1167-1173.
17. R: A language and environment for statistical computing: R Foundation for Statistical Computing, Vienna, Austria - URL http://www.R-project.org/)
18. Cunningham, G., Lädermann, A., Denard, P. J., Kherad, O., & Burkhart, S. S. (2015). Correlation between American shoulder and elbow surgeons and single assessment numerical evaluation score after rotator cuff or SLAP repair. Arthroscopy: The Journal of Arthroscopic & Related Surgery, 31(9), 1688-1692.
19. Varghese, M., Lamb, J., Rambani, R., & Venkateswaran, B. (2014). The use of shoulder scoring systems and outcome measures in the UK. The Annals of The Royal College of Surgeons of England, 96(8), 590-592.
20. Narulla, R., Song, M., Karunaratne, S., Smithers, C., & Petchell, J. (2023). Trends in shoulder surgery patient-reported outcome measures. JSES international, 7(4), 653-661.
21. Vrotsou, K., Ávila, M., Machón, M., Mateo-Abad, M., Pardo, Y., Garin, O., & Cuéllar, R. (2018). Constant–Murley Score: systematic review and standardized evaluation in different shoulder pathologies. Quality of life research, 27, 2217-2226.
22. Kim, H. M., Caldwell, J. M. E., Buza, J. A., Fink, L. A., Ahmad, C. S., Bigliani, L. U., & Levine, W. N. (2014). Factors affecting satisfaction and shoulder function in patients with a recurrent rotator cuff tear. JBJS, 96(2), 106-112.