

Research Article

Health Literacy and Outcomes of Shoulder Arthroplasty Using the Campbell Assessment of Shoulder Education (CASE) Score

Andrew D. Nahr, MD^{1a}, Tanner R. Poppe, MD^{1b}, Carlos A. Rivera-Peraza, BS^{2c}, Derek T. Dixon, BS^{2d}, Tyler J. Brolin, MD^{1e}, Thomas W. Throckmorton, MD^{1f}, David Bernholt, MD^{1g}

¹ Campbell Clinic Department of Orthopaedic Surgery and Biomedical Engineering, University of Tennessee Health Science Center, ² Campbell Clinic Foundation

Keywords: shoulder arthroplasty, health literacy, health literacy assessment

<https://doi.org/10.60118/001c.154241>

Journal of Orthopaedic Experience & Innovation

Vol. 7, Issue 1, 2026

- a Andrew Nahr, MD, is an orthopedic surgery fellow with clinical and research interests in shoulder and elbow surgery, including arthroplasty and postoperative outcomes. His research focuses on optimizing patient-reported outcomes, implant design considerations, and biomechanical factors influencing pain and function following shoulder reconstruction.

[Connect with Dr. Andrew Nahr on LinkedIn](#)

[Conflicts of Interest Statement for Dr. Andrew Nahr](#)

- b [Visit Dr. Tanner Poppe](#)

[Connect with Dr. Tanner Poppe on LinkedIn](#)

[Conflicts of Interest Statement for Dr. Tanner Poppe](#)

- c Carlos Rivera-Peraza is a third-year medical student at the University of Tennessee Health Sciences Center College of Medicine. He is very interested in the field of Physical Medicine and Rehabilitation and hopes to specialize in pediatric rehabilitation.

[Visit Carlos Rivera-Peraza](#)

[Connect with Carlos Rivera-Peraza on LinkedIn](#)

[Conflicts of Interest Statement for Carlos Rivera-Peraza](#)

- d Derek Dixon is a second-year medical student at Ponce Health Sciences University–St. Louis.

[Conflicts of Interest Statement for Derek Dixon](#)

- e Dr. Brolin is a board-certified orthopaedic shoulder and elbow surgeon and Director of Shoulder & Elbow Service at Campbell Clinic in Germantown, TN. He serves as Associate Professor for the Department of Orthopaedic Surgery and Biomedical Engineering at Campbell Clinic – UTHSC and is closely involved with resident and fellow education; additionally serving as Associate Program Director of the Shoulder & Sports Medicine Fellowship. He also sits on the planning committee for the New York Shoulder Arthroplasty Course. Currently administrative roles are robust and include AAOS Central Program Committee and Chair of 2027 Meeting, AAOS Shoulder & Elbow Planning Committee, AAOS Health Care Systems Committee, and ASES Membership Committee.

[Visit Dr. Tyler Brolin](#)

[Connect with Dr. Tyler Brolin on LinkedIn](#)

[Conflicts of Interest Statement for Dr. Tyler Brolin](#)

[Visit the Open Payments Data Page for Dr. Tyler Brolin](#)

- f Dr. Thomas (Quin) Throckmorton is Professor of Orthopaedic Surgery at the University of Tennessee–Campbell Clinic Department of Orthopaedic Surgery.

[Visit Dr. Thomas Throckmorton](#)

[Conflicts of Interest Statement for Dr. Thomas Throckmorton](#)

[Visit the Open Payments Data Page for Dr. Thomas Throckmorton](#)

- g David L. Bernholt, MD, is a board-certified, fellowship-trained sports medicine orthopedic surgeon specializing in arthroscopic and complex knee surgery. He has notable expertise in ACL reconstruction, multi-ligament knee injuries, osteotomies, patellar instability, meniscus repair, and cartilage restoration. Dr. Bernholt is an Associate Professor of Orthopaedic Surgery at the University of Cincinnati.

[Visit Dr. David Bernholt](#)

[Connect with Dr. David Bernholt on LinkedIn](#)

[Conflicts of Interest Statement for Dr. David Bernholt](#)

[Visit the Open Payments Data Page for Dr. David Bernholt](#)

Background

The relationship between patient health literacy and surgical outcomes is an increasingly popular topic within healthcare circles. To our knowledge, no specific assessment of shoulder health literacy has been validated in the literature, and the role that health literacy has in the outcomes of shoulder-arthroplasty patients is unclear.

Purpose

This study aimed to validate the first shoulder-specific health literacy assessment and determine its association with outcomes after shoulder arthroplasty. We hypothesized patients with lower health literacy undergoing shoulder arthroplasty would have worse outcomes.

Methods

A prospective cohort of patients with shoulder pathology (age > 18) were administered the Campbell Assessment of Shoulder Education (CASE) questionnaire and the Literacy in Musculoskeletal Problems survey form (LiMP). We calculated the association between CASE and LiMP survey results by Spearman correlation to validate the CASE questionnaire. A separate prospective cohort of patients undergoing reverse or anatomic total shoulder arthroplasty were then administered the CASE questionnaire at the 3-month postoperative timepoint. We compared pre- and postoperative demographics, American Shoulder Elbow Score (ASES), visual analogue scale (VAS), single assessment numeric evaluation (SANE), and range-of-motion scores for all patients and compared all outcome variables among groups using the health literacy assessment scores.

Results

Patients undergoing total shoulder arthroplasty (N = 202) responded to the questionnaire. The results show a moderate positive association between LiMP and CASE score in the evaluation of health literacy ($r = 0.572$, $p < 0.001$). Patients with poor shoulder literacy (CASE scores < 4) demonstrated higher preoperative VAS scores (6.4 vs. 5.4, $p = 0.005$); however, this difference diminished 3 months postoperatively (2.2 vs 1.8, $p = 0.121$). Patients with poor shoulder literacy did not show inferior ASES (67.7 vs. 69.3, $p = 0.548$) or SANE (62.9 vs. 61.2, $p = 0.612$) scores 3 months postoperatively. We found no differences in external rotation (36.6 vs. 39.7, $p = 0.143$), internal rotation (40.7 vs. 40.0, $p = 0.724$), or forward elevation (128.1 vs 136.0, $p = 0.081$) between groups at the 3-month timepoint.

Conclusions

The CASE tool demonstrated acceptable sensitivity, specificity, and correlation metrics compared with the previously validated LiMP assessment, which indicated it is a reliable tool in evaluating musculoskeletal-specific health literacy. Although inferior shoulder health literacy correlated with worse preoperative VAS score, it was not predictive of postoperative motion or patient-reported outcomes. While inferior shoulder health literacy was correlated with worse preoperative VAS score, it was not predictive of postoperative motion or patient-reported outcomes. Low shoulder-specific health literacy, as measured by CASE, was not predictive of worse short-term postoperative outcomes in this cohort.

INTRODUCTION

Health literacy has been an increasing topic of discussion in the orthopaedic literature (Coscic, Kimmel, and Edwards 2017; Lans, Bales, Borkhetaria, et al. 2023; Lans et al. 2023; Lans and Schwab 2023; Mertz, Eppler, Shah, et al. 2022; Narayanan et al. 2021; Tarabochia, Menendez, and Ring 2021). While definitions can have many iterations, our preferred description of health literacy refers to the degree to which a patient can obtain, process, and understand information regarding their overall health, healthcare conditions, and treatment options (Baker 2006). Individual pa-

tient health literacy can vary across different aspects of medicine, as baseline comprehension between topics fluctuates (U.S. Department of Health and Human Services 2000). Specifically, general health literacy may not accurately reflect orthopaedic-specific health literacy. Rosenbaum et al (Rosenbaum, Pauze, Pauze, et al. 2015). were the first to demonstrate this distinction using the validated Literacy in Musculoskeletal Problems (LiMP) questionnaire, which revealed significantly lower orthopaedic knowledge compared with general health literacy among their study participants.

Lower health literacy has been associated with worse clinical outcomes in a number of medical specialties, and orthopaedic surgery is no different (Wright, Edwards, Gogins, et al. 2018; Theiss, Wood, McLeod, et al. 2022; Dumitra, Ganescu, Hu, et al. 2021). Narayanan et al (Narayanan et al. 2021). assessed 450 patients undergoing total knee arthroplasty using the LiMP questionnaire and found that lower health literacy was associated with worse overall satisfaction after surgery. Similarly, Lans et al (Lans and Schwab 2023). evaluated 318 patients with back pain and found that poor health literacy was linked to lower baseline patient-reported outcome measures (PROMs) at the time of their initial visit to a spine clinic. Strahl et al (Strahl, Bucker, Bechler, et al. 2024). reported that higher health literacy was positively correlated with increased satisfaction 1 month after total hip arthroplasty. Recently, health literacy has been studied in the context of shoulder arthroplasty and was shown to be associated with differences in preoperative pain and function as well as perioperative hospital length of stay (Puzzitiello, Colliton, Swanson, et al. 2022).

The large number of new studies being published in orthopaedic surgery literature on the relationship between health literacy and outcomes has driven the need for system-specific validated scoring systems to accurately evaluate the broad spectrum of orthopaedic patients (Lans et al. 2023). This work aims to be the first to describe a validated, shoulder-specific health literacy assessment the “Campbell Assessment of Shoulder Education” (CASE) score. In addition, we aimed to evaluate patients undergoing shoulder arthroplasty and how varying health literacy affects outcomes postoperatively. Our hypothesis was that lower baseline health literacy would result in inferior patient-reported outcomes and worse postoperative range of motion after shoulder arthroplasty.

MATERIALS AND METHODS

VALIDATION OF THE CASE QUESTIONNAIRE WITH LiMP

As also described in our sister study evaluating health literacy and outcomes of rotator cuff repair, we first sought to validate CASE against a previously accepted and validated assessment of musculoskeletal health literacy, the LiMP score. Our shoulder-specific health literacy assessment instrument was developed collaboratively by the board-certified sports medicine and shoulder/elbow trained orthopaedic surgeons authoring this study using the LiMP assessment tool as a guide in terms of presentation of questions and length of assessment. The created instrument, called CASE, is presented in [Figure 1](#). The final version of the CASE questionnaire included nine multiple-choice, single-answer questions written at the 3.6 Grade Level per Flesch-Kincaid readability score. After approval from the Institutional Review Board of the University of Tennessee Health Science Center (IRB #20-07870-XP), patients presenting to an outpatient shoulder clinic were enrolled in the study and completed both the LiMP and CASE assessments, either by mail or in-person, after providing in-

formed consent. The inclusion criteria for this portion of the study were adult patients (age ≥ 18) presenting with shoulder pathology. Patients whose primary language was not English, as well as those presenting with acute shoulder trauma, were excluded. The scores from both instruments were compared to validate the CASE test as an effective tool for assessing shoulder health literacy, with LiMP and CASE scores analyzed using a contingency table, sensitivity and specificity analyses, and Spearman correlation coefficients.

SHOULDER ARTHROPLASTY OUTCOMES AND HEALTH LITERACY

Patients who were not included in the CASE validation cohort who were scheduled to undergo primary anatomic or reverse total shoulder arthroplasty were then voluntarily enrolled into the second stage of the study. A preliminary power analysis was conducted to determine sample size based on the minimally important clinical difference in forward elevation postoperatively. Patients were excluded from participating if undergoing revision arthroplasty or arthroplasty for proximal humeral fracture. Both the CASE and LiMP assessments were administered to patients by mail 3 months after shoulder arthroplasty. All patients participated in the institute's standard physical therapy and rehabilitation protocols for TSA and RSA respectively. These results were then correlated with patient demographics, as well as patient-reported outcome measures including pre- and postoperative American Shoulder Elbow and Elbow Surgeons (ASES), visual analogue scale (VAS), single assessment numeric evaluation (SANE) scores, and range of motion.

After each patient completed the CASE assessment, they were placed into either a ‘high literacy’ or ‘low literacy’ category based on their score being 5 or higher, or 4 and lower, respectively. Scores of 4 and 5 were chosen based on measures of central tendency for the data set and distribution of scores for CASE and LiMP. Fisher's exact test was used to assess for significant differences in patient demographics (e.g., gender, race, education, healthcare experience, complications, operating surgeon) comparing the high and low literacy groups. Student's *t*-test was used to assess for differences inpatient age, and continuous outcome measurements (ASES, SANE, VAS, and range-of-motion measurements [ROM], forward elevation, external rotation in adduction, and internal rotation behind the back) acquired preoperatively, at 3 months postoperatively, and the difference between 3 months and preoperative according to literacy group. The latter delta metric was also analyzed using a nonparametric median test. Continuous outcomes (ASES, SANE, VAS, ROM) were further analyzed adjusting for significant demographic and joint history using general linear model analyses. *P*-values $< 5\%$ (0.05) were considered statistically significant.

1. External rotation of the shoulder would be to:
 - ☐ Touch your belly
 - ☐ Raise your hand
 - ☐ Turn your body to the left or right
 - ☐ Touch the back of your head
 - ☐ I don't know
2. Which of the following is passive motion of the shoulder?
 - ☐ Lifting your arm over your head
 - ☐ Climbing a ladder
 - ☐ Someone raises your arm for you
 - ☐ Doing jumping jacks
 - ☐ I don't know
3. What is the name of the bone in your upper arm?
 - ☐ Radius
 - ☐ Ulna
 - ☐ Shoulder blade
 - ☐ Humerus
 - ☐ I don't know
4. Which of these is an example of flexing the shoulder to 90 degrees?
 - ☐ Raising a weight to shoulder height
 - ☐ Tucking in a shirt
 - ☐ Wearing a sling with your arm at the side
 - ☐ Bringing a fork to your mouth
 - ☐ I don't know
5. What is your rotator cuff?
 - ☐ The ball and socket in your shoulder
 - ☐ A group of muscles and tendons in your shoulder
 - ☐ The bones in your shoulder
 - ☐ The nerves running from your neck to your shoulder
 - ☐ I don't know
6. _____ is when cartilage is worn down in your shoulder joint.
 - ☐ Arthritis
 - ☐ A labrum tear
 - ☐ A rotator cuff tear
 - ☐ A sprain
 - ☐ I don't know
7. A _____ is when the ball of the shoulder joint gets stuck out of place after an injury.
 - ☐ Shoulder sprain
 - ☐ Broken shoulder
 - ☐ Shoulder dislocation
 - ☐ Rotator cuff tear
 - ☐ I don't know
8. Which of these is part of the shoulder?
 - ☐ Rotary cup
 - ☐ ACL
 - ☐ Scapula
 - ☐ Funny bone
 - ☐ I don't know
9. If you have a break in your shoulder, which treatment would your doctor suggest to help you heal?
 - ☐ Massage
 - ☐ Exercise
 - ☐ Heat
 - ☐ A sling
 - ☐ I don't know

Figure 1. Campbell Assessment of Shoulder Education (CASE)

RESULTS

CASE VALIDATION

After preliminary power analysis, 65 patients completed both the LiMP and CASE assessment for validation. See tables below for baseline demographics (Tables I and II). The average age of participants was 61 years old. Most patients had a high school education or greater. The mean score for CASE and LiMP was 5.2 and 5.6, respectively. See Figures 2 and 3 for breakdowns of scoring on each assessment. Nonparametric Spearman rank-order correlation was used to compare results between CASE and LiMP surveys and found a moderate positive correlation with $r = 0.572$, and $P < 0.001$. These results suggest validation of CASE regarding its ability to accurately assess shoulder health literacy.

SHOULDER ARTHROPLASTY AND HEALTH LITERACY

A total of 202 patients undergoing both standard and reverse total shoulder arthroplasty responded to the mailing questionnaire CASE and LiMP surveys 3 months after surgery. A cutoff of less than or equal to a score of 4 on CASE was used to represent low health literacy. A total of 117 patients were found to have good literacy, and 85 (42%) were found to have poor literacy. Demographically, as has been shown in previous literature, White patients tended to have higher literacy than other races, and Black patients tended to have lower literacy ($P < 0.05$) (Rosenbaum, Pauze, Pauze, et al. 2015; Shea et al. 2004). Higher baseline education and previous healthcare experience was associated with higher scores on CASE assessment ($P < 0.05$). Patients with poor shoulder literacy demonstrated higher preoperative VAS score (6.4 vs. 5.4, $P = .005$); however, there was no difference in VAS 3 months postoperatively (2.2 vs 1.8, $P = 0.121$). Additionally, patients with lower health literacy tended to have lower baseline values in forward elevation

Table I. Demographic values for CASE validation

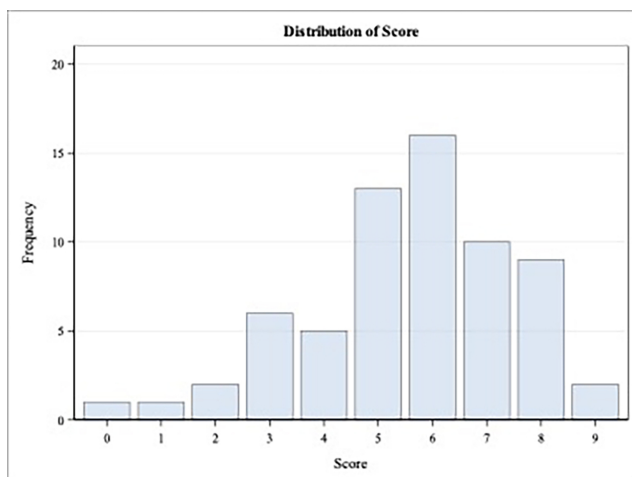
	N	Col %
Gender		
Female	39	60.0
Male	26	40.0
Race		
Asian	1	1.5
Black	22	33.8
Hispanic	3	4.6
White	39	60.0

CASE, Campbell Assessment of Shoulder Education

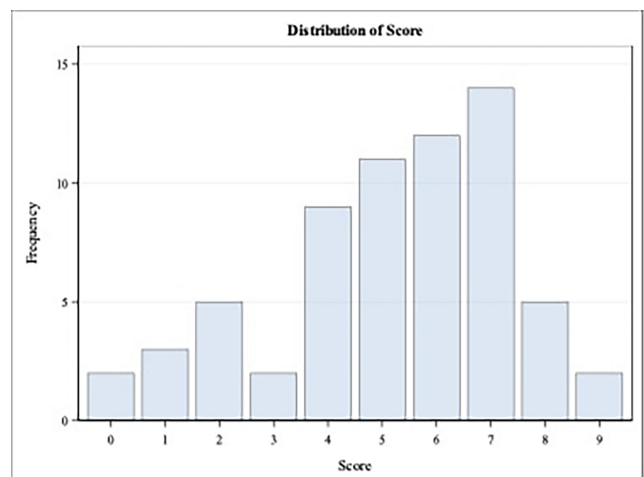
Table II. Baseline Education for CASE Validation

Education	N	Col%
Associate's degree	13	20.0
Bachelor's degree	19	29.2
High school or GED	16	24.6
Master's degree	7	10.8
PhD or equivalent	1	1.5
Some high school	4	6.2
Trade school	5	7.7
Healthcare experience		
No	43	66.2
Yes	22	33.8
Total subject number (N)	65	100

CASE, Campbell Assessment of Shoulder Education

**Figure 2. Literacy in Musculoskeletal Problems (LiMP) survey score distribution**

(84 vs. 116), external rotation (81 vs. 114), and internal rotation (107 vs. 82), although this was not statistically significant ($P > 0.05$). Patients with poor shoulder literacy did not show inferior ASES (67.7 vs. 69.3, $P = 0.548$) or SANE (62.9 vs. 61.2, $P = 0.612$) scores 3 months postoperatively.

**Figure 3. Campbell Assessment of Shoulder Education (CASE) score distribution**

There was no difference in external rotation (36.6 vs. 39.7, $P = 0.143$), internal rotation (40.7 vs. 40.0, $P = 0.724$), or forward elevation (128.1 vs. 136.0, $P = 0.081$) between groups at the 3-month timepoint. The change in forward elevation following surgery was greater for the patients with higher

health literacy (48.8 vs. 35.9); however, this failed to reach statistical significance ($P = 0.059$).

DISCUSSION

This study should be interpreted as a pilot investigation designed to explore short-term associations between shoulder-specific health literacy and early postoperative outcomes. We believe several portions of this work will be important in future literature. First, the lack of a shoulder-specific health literacy assessment has been an obstacle in accurately evaluating the importance of health literacy on specific subspecialties of orthopaedics. With the wide variety of nonspecific tools used in orthopaedics currently, there is a need for standardization in the academic literature (Baker et al. 1999; Davis, Long, Jackson, et al. 1993; Gottfredson 1997; Nurss 2001; Parker et al. 1995; Weiss, Mays, Martz, et al. 2005). As shown previously, health literacy is fluid and changes between medical subspecialties based on a number of baseline patient factors. Without an accurate assessment of shoulder knowledge, it would be difficult to evaluate how interventions aimed at increasing health literacy in this area can be improved. We believe CASE provides a relatively simple, validated, and effective assessment in this area which is easy to understand across a broad range of patient backgrounds (3.6 Flesch-Kincaid).

This pilot study adds to the growing evidence that disparities in health literacy can be addressed through proper perioperative patient education and should not preclude the treatment of surgical pathologies. Consistent with prior research, lower health literacy in our population was associated with risk factors such as nonwhite race, lower baseline education, and no past healthcare experience. In our cohort alone, 42% of patients assessed were classified as having low health literacy in the early postoperative period. Previous work in the knee and spine literature would suggest lower health literacy correlates with worse patient-reported outcomes, higher pain scores, and increased complications (Puzzitiello, Colliton, Swanson, et al. 2022). Such disparities have the potential to impact surgical decision-making, potentially denying high-risk patients access to necessary care. Our study differs from previous work in that, although low health literacy was associated with higher preoperative VAS pain scores, there were no significant differences in patient-reported outcome measures, VAS pain scores, or range of motion between groups at any time point up to 3 months postoperatively. This suggests that similar outcomes can be achieved in patients undergoing shoulder arthroplasty regardless of health literacy at short term follow-up. It is important to note that considerable preoperative education was provided by the attending surgeon regarding the diagnosis and treatment modalities preoperatively, which likely had an impact on patient health literacy at the time of surgery.

While our patient follow-up was relatively short at 3 months, we believe this timeframe is justified in its representation of the immediate preoperative and postoperative shoulder arthroplasty patients, as most improvement will be seen in the first 3 months. The finding of an increased baseline in VAS score in patients with lower health literacy provides an interesting opportunity for expanding our current conservative therapy in patients with degenerative shoulder disease. Both patients with “high” and “low” health literacy VAS scores became equivalent postoperatively, perhaps indicating the effectiveness of perioperative counseling and education done by surgeons.

This study has several limitations. It was conducted at a single institution with a two-surgeon patient population, which may reduce generalizability and limit demographic diversity. Differences in preoperative and perioperative instruction may also have influenced outcomes and further restricted external applicability. Both surgeons in our cohort provide a high degree of preoperative education which may not reflect all practice environments and could limit the applicability of these findings to settings with different baseline health-literacy resources. Additionally, we included both anatomic and reverse shoulder arthroplasty patients, as well as a mix of inpatient and outpatient procedures, which introduces heterogeneity into our cohort. The follow-up period was relatively short at only 3 months postoperatively, which limits assessment of longer-term outcomes. These factors may have influenced our findings and should be considered when interpreting the results. Future work should include larger, multi-institutional cohorts with more demographic diversity, along with longer-term postoperative follow-up, to validate and expand upon these early findings.

CONCLUSIONS

CASE’s sensitivity, specificity, and Spearman correlation testing compared with the previously validated LiMP assessment indicate that it is a reliable tool in evaluating musculoskeletal-specific health literacy. While inferior shoulder health literacy was correlated with worse preoperative VAS score, it was not predictive of postoperative motion or patient-reported outcomes. Low shoulder-specific health literacy, as measured by CASE, was not predictive of worse short-term postoperative outcomes in this cohort. We hope to utilize CASE in future work to further explore how health literacy can be optimized preoperatively and also its implications in longer term follow-up.

Submitted: October 13, 2025 EDT. Accepted: December 11, 2025 EDT. Published: May 23, 2026 EDT.



This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CCBY-NC-ND-4.0). View this license's legal deed at <https://creativecommons.org/licenses/by-nc-nd/4.0> and legal code at <https://creativecommons.org/licenses/by-nc-nd/4.0/legalcode> for more information.

REFERENCES

- Baker, D. W. 2006. "The Meaning and the Measure of Health Literacy." *J Gen Intern Med* 21:878–83. <https://doi.org/10.1111/j.1525-1497.2006.00540.x>.
- Baker, D. W., M. V. Williams, R. M. Parker, J. A. Gazmararian, and J. Nurss. 1999. "Development of a Brief Test to Measure Functional Health Literacy." *Patient Educ Couns* 38:33–42. [https://doi.org/10.1016/s0738-3991\(98\)00116-5](https://doi.org/10.1016/s0738-3991(98)00116-5).
- Cosic, F., L. Kimmel, and E. Edwards. 2017. "Health Literacy in Orthopaedic Trauma Patients." *J Orthop Trauma* 31 (3): e90–5. <https://doi.org/10.1097/BOT.0000000000000764>.
- Davis, T.C., S.W. Long, R.H. Jackson, et al. 1993. "Rapid Estimate of Adult Literacy in Medicine: A Shortened Screening Instrument." *Fam Med* 25:391–95.
- Dumitra, T., O. Ganescu, R. Hu, et al. 2021. "Association between Patient Activation and Health Care Utilization after Thoracic and Abdominal Surgery." *JAMA Surg* 156 (1): e205002. <https://doi.org/10.1001/jamasurg.2020.5002>.
- Gottfredson, L. 1997. "Why g Matters: The Complexity of Everyday Life." *Intelligence* 24:79–132. [https://doi.org/10.1016/S0160-2896\(97\)90014-3](https://doi.org/10.1016/S0160-2896(97)90014-3).
- Lans, A., J. R. Bales, P. Borkhetaria, et al. 2023. "Impact of Health Literacy on Self-Reported Health Outcomes in Spine Patients." *Spine (Phila Pa 1976)* 48 (7): E87–93. <https://doi.org/10.1097/BRS.0000000000004495>.
- Lans, A., J. R. Bales, M. S. Fourman, P. P. Borkhetaria, J. J. Verlaan, and J. H. Schwab. 2023. "Health Literacy in Orthopedic Surgery: A Systematic Review." *HSS J* 19 (1): 120–27. <https://doi.org/10.1177/15563316221110536>.
- Lans, A., and J. H. Schwab. 2023. "Health Literacy in Orthopaedics." *J Am Acad Orthop Surg* 31 (8): 382–88. <https://doi.org/10.5435/JAAOS-D-22-01026>.
- Mertz, K., S. Eppler, R. F. Shah, et al. 2022. "Health Literacy and Patient Participation in Shared Decision-Making in Orthopedic Surgery." *Orthopedics* 45 (4): 227–32. <https://doi.org/10.3928/01477447-20220401-04>.
- Narayanan, A. S., K. E. Stoll, L. F. Pratson, F. C. Lin, C. W. Olcott, and D. J. Del Gaizo. 2021. "Musculoskeletal Health Literacy Is Associated with Outcome and Satisfaction of Total Knee Arthroplasty." *J Arthroplasty* 36 (7S): S192–7. <https://doi.org/10.1016/j.arth.2021.02.075>.
- Nurss, J. 2001. *TOFHLA Test of Functional Health Literacy in Adults*. Peppercorn Books and Press.
- Parker, R. M., D. W. Baker, M. V. Williams, and J. R. Nurss. 1995. "The Test of Functional Health Literacy in Adults: A New Instrument for Measuring Patients' Literacy Skills." *J Gen Intern Med* 10:537–41. <https://doi.org/10.1007/BR02640361>.
- Puzzitiello, R. N., E. M. Colliton, D. P. Swanson, et al. 2022. "Patients with Limited Health Literacy Have Worse Preoperative Function and Pain Control and Experience Prolonged Hospitalizations Following Shoulder Arthroplasty." *J Shoulder Elbow Surg* 31 (12): 2473–80. <https://doi.org/10.1016/j.jse.2022.05.001>.
- Rosenbaum, A. J., D. Pauze, D. Pauze, et al. 2015. "Health Literacy in Patients Seeking Orthopaedic Care: Results of the Literacy in Musculoskeletal Problems (LIMP) Project." *Iowa Orthop J* 35:187–92.
- Shea, J. A., B. B. Beers, V. J. McDonald, D. A. Quistberg, K. L. Ravenell, and D. A. Asch. 2004. "Assessing Health Literacy in African American and Caucasian Adults: Disparities in Rapid Estimate of Adult Literacy in Medicine (REALM) Scores." *Fam Med* 36 (8): 575–81.
- Strahl, A., L. Bucker, U. Bechler, et al. 2024. "Influence of Health Literacy on Health-Related Quality of Life after Total Hip Arthroplasty." *Arch Orthop Trauma Surg* 144 (3): 1389–1400. <https://doi.org/10.1007/s00402-023-05098-0>.
- Tarabochia, M., M. E. Menendez, and D. Ring. 2021. "Health Literacy and Decisional Preferences in Hand Surgery." *J Hand Surg Am* 46 (1): 70.e1–8. <https://doi.org/10.1016/j.jhsa.2020.08.008>.
- Theiss, T. M., T. Wood, M. C. McLeod, et al. 2022. "The Association of Health Literacy and Postoperative Complications after Colorectal Surgery: A Cohort Study." *Am J Surg* 223 (6): 1047–52. <https://doi.org/10.1016/j.amjsurg.2021.10.024>.
- U.S. Department of Health and Human Services. 2000. *Healthy People 2010: Understanding and Improving Health*. 2nd ed. Washington, DC: U.S. Government Printing Office.

Weiss, B. D., M. Z. Mays, W. Martz, et al. 2005. "Quick Assessment of Literacy in Primary Care: The Newest Vital Sign." *Ann Fam Med* 3:514–22. <https://doi.org/10.1370/AFM.405>.

Wright, J. P., G. C. Edwards, K. Goggins, et al. 2018. "Association of Health Literacy with Postoperative Outcomes in Patients Undergoing Major Abdominal Surgery." *JAMA Surg* 153 (2): 137–42. <https://doi.org/10.1001/jamasurg.2017.3832>.