



## Low socioeconomic status worsens access to care and outcomes for rotator cuff repair: a scoping review



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**Background:** Poor socioeconomic status (SES) is consistently associated with poor quality of health care, particularly in the field of orthopedics. Expanding insurance coverage has created a larger patient population by specifically making health care more accessible, translating to greater demand for care in the low-SES population. The purpose of this article is to provide a scoping review of literature observing access and outcomes of rotator cuff repair surgery among low-SES populations.

**Methods:** We performed a systematic review of articles using PubMed, Embase, and EBSCO (May 2021) from 2010 onward. Peer-reviewed articles that recorded at least one SES measure specific to patients who underwent rotator cuff repair from the United States were included. SES measures were methodically defined as income, occupation, employment, education, and race. All data that aligned with these SES measures were extracted.

**Results:** Of the 1009 titles reviewed, 109 studies were screened by abstract, 23 were reviewed in full, and 7 studies met criteria for inclusion. Of the 5 studies investigating access, all 5 found disparities among postoperative physical therapy, orthopedic consult, and surgery, using Medicaid status as a proxy for income in addition to other income measures. Of the 3 studies analyzing outcomes, 2 found that low-SES patients had worse pain and function, again based on Medicaid status and other income measures. Education did not have a significant impact on outcomes, as per the 1 study that included it. No studies included measures of occupation or employment.

**Conclusion:** Patients of low SES face reduced access to cuff repair care and worse associated outcomes, despite federal and state government efforts to reduce health care disparity through health care reform. The small nature of this review reflects how measures of SES are often not examined in rotator cuff repair studies.

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Poor socioeconomic status (SES) has historically been closely associated with poor health care access and outcomes.<sup>2</sup> The inception of the Affordable Care Act in 2010, and the ensuing Medicaid expansion in 2014, aimed at addressing disparities in American health care.<sup>45</sup> Improvements have been seen in several medical specialties regarding access, coverage, affordability, and outcomes.<sup>25,29,32,47</sup> Questions remain, however, on if these benefits have reached the field of orthopedic surgery.<sup>15,28,36,62</sup> Several studies have noted reduced access to care for low-SES patients for conditions such as ankle fracture,<sup>28</sup> meniscus tear,<sup>63</sup> flexor tendon laceration,<sup>14</sup> and pediatric injury.<sup>41,53,54</sup> Furthermore, worse postoperative outcomes associated with low SES persist in orthopedic

surgeries, such as total joint arthroplasties<sup>13,59</sup> and spine surgery.<sup>31,35</sup> Several studies observe similar trends in care for rotator cuff tear.<sup>8,12,24,30,39,44,48</sup>

Rotator cuff tears are one of the most common causes of shoulder pain and dysfunction, with some estimating a near 20% prevalence in adults.<sup>64,65</sup> These injuries present both direct and indirect costs, such as loss of income due to missed work<sup>37</sup> and negative impacts on mental health.<sup>9</sup> Rotator cuff repair surgery is highly effective at improving function and quality of life,<sup>10,18,34</sup> and 250,000 patients undergo cuff repair annually.<sup>37</sup> Rates are expected to rise with the aging population,<sup>37</sup> in addition to greater demand in low-income populations created by expanded Medicaid coverage under the Affordable Care Act.<sup>5</sup> Meanwhile, socioeconomic disparity is pervasive in the United States, indicated by the 34.0 million living under the poverty line,<sup>51</sup> 72.2 million adults covered under government-subsidized health care,<sup>38</sup> and 92.5 million with only a high school degree.<sup>58</sup>

Institutional review board approval was not required for this review article.

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The purpose of this study was to review the existing literature examining access and outcomes of rotator cuff repair surgery among low-SES individuals.

**Methods**

A scoping literature review was conducted using PubMed, Embase, and EBSCO in June 2021. Our purpose was to identify and include all English-language, peer-reviewed studies on access to rotator cuff surgery care and outcomes for low-SES populations. The search was completed using keywords: “rotator cuff”, “disparities”, “socioeconomic status”, “economic status”, “social status”, “insurance”, “Medicare”, “Medicaid”, “income”, “ethnicity”, “access”, and “predictors”. The search strategy for PubMed is presented in [Table I](#).

Study time limit was set to March 2010 onward in effort to scope around the time which Affordable Care Act was signed into law, fundamentally changing health care access in the United States of America.<sup>45,47</sup> Results had to be specific to patients who underwent rotator cuff repair, excluding shoulder arthroplasty and solely nonoperative treatment. Further inclusion criteria required studies to include at least one measure of SES; only one SES measure was required in effort to obtain a fuller scope, and primary measures of SES were defined according to the American Psychologic Association and the US Department of Justice: occupation, income, education level, and employment.<sup>1,4</sup> In addition, we chose to include ethnicity as a measure because minority ethnicities are shown to be closely associated with low SES.<sup>1,2</sup> Inclusion was limited to US populations with the notion that socioeconomic influences on health care in the United States differed from that of other countries based on several factors, such as health care laws and practice.<sup>42</sup> Articles without full text available and those based on opinion were excluded.

All titles and abstracts were reviewed for relevance. Those relevant progressed to full-text reviews for inclusion. Relevance was defined by clear naming of an SES measure, the implication of disparity in association with access or outcome, or focus on predictors of care. Data were extracted and included measures of SES, number of subjects, and patient characteristics. In addition, all result data that aligned with SES measures, including statistical analysis regarding access and outcome (ie, measures of central tendency, relative ratios, confidence intervals, regression models), were also extracted for summary ([Table I](#)).

Two reviewers independently assessed the methodological quality and reliability of the included studies. Cohort studies were evaluated using the Newcastle-Ottawa Scale,<sup>61</sup> and cross-sectional studies were evaluated using an adapted Newcastle-Ottawa Scale.<sup>23</sup> Studies were assessed for potential sources of biases, generalizability, and control of confounding factors. Reviewers resolved discrepancies by consensus. Studies were included if they were, at least, “satisfactory” ([Table II](#)). Risk of bias across studies to assess cumulative evidence was determined independently by two authors and settled by consensus.

**Results**

The search strategy yielded 1695 studies after duplicate screening within searches, 686 of which were removed as duplicates across searches leaving 1009 titles reviewed. Of these, 109 studies were screened by abstract and 23 were reviewed in full. All authors came to a consensus for the 7 studies that met criteria for inclusion ([Fig. 1](#)). Collectively, these studies consisted of 674 provider clinic visits (603 physical therapies and 71 outpatient orthopedics) and 50,898 patients with cuff tear. Six studies assessed SES based on income, 2 studies additionally used race, and one

**Table 1**  
The search strategy used for PubMed.

Search strategy: Pubmed			
1.	Rotator cuff	7.	Medicare
2.	Disparities	8.	Medicaid
3.	Socioeconomic status	9.	Income
4.	Economic status	10.	Ethnicity
5.	Social status	11.	Access
6.	Insurance	12.	Predictors
Search term: 1 AND (2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11 OR 12)			
Limits: Date: 2010-2021; Language: English			

study solely used the highest level of education. In 4 studies, data were obtained via cross-sectional design, whereas 3 studies were carried out by cohort design, 2 of which were retrospective.

Significant disparity in access to care for low-SES patients with cuff tear was found in all 5 of the studies that explored access ([Table II](#)). All five of these studies used government-subsidized health insurance as a proxy for individual income to represent SES. In addition, 3 noted regional income measures, and 2 recorded patient race. Rogers et al<sup>44</sup> and Curry et al<sup>12</sup> reported this finding in physical therapy clinics. Patterson et al<sup>39</sup> reported on outpatient orthopedic practices. Finally, Chapman et al<sup>8</sup> and Li et al<sup>30</sup> reported on medical centers.

Rogers et al<sup>44</sup> and Curry et al<sup>12</sup> conducted cross-sectional analysis of physical therapy clinics posing as Medicaid and privately insured patients who underwent cuff repair. In both studies, Medicaid insurance was accepted less often than private insurance. Rogers et al<sup>44</sup> found that Medicaid patients encountered longer average days to first appointment, and low community income measures had no significant impact. Curry et al<sup>12</sup> found the opposite, with an insignificant difference in wait time and physical therapy clinics more likely to accept Medicaid lower household income communities. Medicaid expansion states had higher overall rates of coverage acceptance, although a greater range of wait times, which the authors suggest may be indicative of demand exceeding supply. Patterson et al<sup>39</sup> presented similar findings for orthopedic practices, with reduced Medicaid acceptance. There was no significant difference in wait time, although Medicaid patients were less likely to receive an appointment within the requested 2 weeks. Chapman et al<sup>8</sup> retrospectively investigated treatment decisions for atraumatic rotator cuff tears and found that lower income and minority race played a significant role. Specifically, African American and Hispanic patients were less likely than Caucasian patients to undergo surgery and more likely to be treated with watchful waiting; African Americans were also less likely to undergo physical therapy. Medicaid dual-eligible patients had similar findings to African Americans. Although several factors could have influence (eg, physician bias and patient attitude), the authors objectively identify the confounding impact of geographic variation as regions with a greater supply of surgeons and physical therapists had higher surgery rates and physical therapy rates, respectively. Li et al<sup>30</sup> found disparity between the patient populations of low- and high-volume facilities and surgeons. Univariate analysis revealed that low-volume facilities and surgeons saw a greater proportion of Medicaid patients, low-income patients, and minority race patients ([Table II](#)). In all these studies, the regional nature poses a potential source of selection bias, limiting their generalizability and ability to analyze confounding community characteristics ([Table III](#)).

Of the 3 studies recording outcomes, 2 measured significant disparity in outcomes for patients who underwent rotator cuff repair of lower SES ([Table II](#)). These two studies, the studies by Li et al<sup>30</sup> and Sabesan et al<sup>48</sup>, used government-subsidized insurance

**Table II**  
Summary of included articles.

Article title	Date	Authors	Study design	Evidence	Focus	Participant total	Participant details	SES measure	Data	Summary of disparity
Insurance status affects access to physical therapy after rotator cuff repair surgery: A comparison of privately insured and Medicaid patients <sup>44</sup>	Jan-19	Rogers et al	Cross-sectional study	Level 4	Access	138	PT clinics in the Greater Boston Area	Income <sup>l</sup>	Medicaid vs. private Accepted: 71 (51%) vs. 133 (96%), $P = .019$ Days to appointment: 8.3 days (95% CI 7.13, 9.38) vs. 6.3 days (95% CI 5.3, 7.22), $P = .001$	Fewer PT clinics accepted Medicaid, and Medicaid patients had a longer wait time for the first available appointment.
National disparities in access to physical therapy after rotator cuff repair between patients with Medicaid vs. private health insurance <sup>12</sup>	Jan-21	Curry et al	Cross-sectional study	Level 4	Access	465 <sup>†</sup>	PT clinics from urban centers in all 50 states and Washington DC	Income <sup>†</sup>	Medicaid vs. private Accepted: 245 (53%) vs. 441 (95%), $P < .00001$ Days to appointment: 2, IQR: 1-4 Range (expansion/nonexpansion): 0-72/0-10 vs. 0-43/0-11 Accepted (expansion/nonexpansion): 56%/46% ( $P = .05$ ) vs. 97%/91% ( $P = .01$ )	Fewer PT clinics accepted Medicaid in all states, although a patient in a Medicaid-expansion state was more likely to receive an appointment than one in a nonexpansion state.
Access to outpatient care for adult rotator cuff patients with private insurance vs. Medicaid in North Carolina <sup>39</sup>	Oct-14	Patterson et al	Cross-sectional	Level 4	Access	71	Orthopaedic practices in North Carolina	Income <sup>*</sup>	Medicaid vs. private Accepted: 51 (72%) vs. 68 (96%), $P < .001$ Appointment within 2 weeks: 49 (69%) vs. 65 (92%), $P = .001$	The Medicaid patient was offered an appointment less frequently than the privately insured patient. In addition, the Medicaid patient was less likely to receive an appointment in the requested time frame.
Treatment for rotator cuff tear is influenced by demographics and characteristics of the area where patients live <sup>8</sup>	Sep-18	Chapman et al	Retrospective cohort Study	Level 3	Access	32,203	Medicare patients with atraumatic RCT: C: 29,644 (92.1%) AA: 1389 (4.3%) H: 401 (1.2%) A: 264 (0.8%) Other: 505 (1.6%) MDE: 2204 (6.8%)	Race, income <sup>*</sup>	Odds of surgery <sup>§</sup> : AA: 0.78 ( $P < .01$ , 95% CI 0.67, 0.91) H: 0.61 ( $P < .01$ , 95% CI 0.44, 0.87) MDE: 0.70 ( $P < .001$ , 95% CI 0.61, 0.81) Odds of physical therapy <sup>¶</sup> : AA: 0.81 ( $P < .01$ , 95% CI 0.73, 0.91) H: 1.02 ( $P > .05$ , 95% CI 0.82, 1.26) MDE: 0.63 ( $P < .001$ , 95% CI 0.57, 0.69) Odds of watchful wait <sup>‡</sup> : AA: 1.41 ( $P < .001$ , 95% CI 1.26, 1.57) H: 1.23 ( $P < .1$ , 95% CI 0.99, 1.52) MDE: 1.86 ( $P < .001$ , 95% CI 1.69, 2.04)	Minority race and Medicaid-AA: dual-eligibility patients had lower odds of surgery and higher odds of watchful waiting.

Table II (continued)

Article title	Date	Authors	Study design	Evidence Level	Focus	Participant total	Participant details	SES measure	Data	Summary of disparity
Disparities in cost and access by caseload for arthroscopic rotator cuff repair: An analysis of 18,616 cases <sup>30</sup>	Jun-19	Li et al	Cross-sectional study	Level 4	Access and outcome	18,616	RCR patients in Florida: C: 15,153 (81.4%) AA: 1452 (7.8%) H: 1880 (10.1%) A: 112 (0.6%) NA: 19 (0.1%) Medicaid: 372 (2.0%)	Race, income <sup>1</sup>	Low- vs. high-volume facilities (%): AA: 8.1 vs. 7.5, $P < .001$ H: 12.4 vs. 8.3, $P < .001$ Medicaid: 3.0 vs. 1.3, $P < .001$ Low income: 69.5 vs. 61.2, $P < .001$ Readmission: 4.95 ± 21.7 vs. 2.43 ± 15.4, $P < .001$ Low- vs. high-volume surgeons (%): AA: 8.4 vs. 7.1, $P < .001$ H: 10.9 vs. 9.3, $P < .001$ Medicaid: 3.1 vs. 0.9, $P < .001$ Low income: 70.3 vs. 61.2, $P < .001$ Readmission: 4.79 ± 21.4 vs. 2.87 ± 16.7, $P < .001$	Low-volume facilities and surgeons saw more low minority race patients and had higher readmission rates.
The effect of Medicaid payer status on patient outcomes after repair of massive rotator cuff tears <sup>48</sup>	Nov-17	Sabesan et al	Retrospective cohort Study	Level 3	Outcome	29	Medicaid (14) and non-Medicaid (15) patients with Massive RCR patients, undergone surgery by 1 surgeon	Income <sup>*</sup>	Medicaid vs. non-Medicaid postoperative: ASES: 53.7 ± 28.8 vs. 71.3 ± 22.5 $P = .095$ effect size: $d = 0.1$ PSS: 54.5 ± vs. 70.9 ± 21.6, $P = .105$ effect size: $d = -0.4$ SVV: 60.3 ± 18.8 vs. 75 ± 15.1, $P = .106$ effect size: $d = -0.7$ Medicaid preoperative vs. postoperative: Forward flexion: 107 ± 46 vs. 164 ± 34, $P = .002$ Abduction: 105 ± 60 vs. 142 ± 50, $P = .253$ External rotation: 38 ± 26 45 ± 24, $P = .448$ Non-Medicaid preoperative vs. postoperative: Forward flexion: 108 ± 53 vs. 159 ± 23 $P = .004$ Abduction: 94 ± 51 vs. 158 ± 45, $P = .048$ External rotation: 40 ± 22 vs. 52 ± 28, $P = .101$	Both groups had significant improvement from baseline; however, Medicaid patients had slightly worse ROM. Disparities in pain and function scores were present by mean, although insignificant; effect size trended better for non-Medicaid patients.

(continued on next page)

Table II (continued)

Article title	Date	Authors	Study design	Evidence Focus	Participant total	Participant details	SES measure	Data	Summary of disparity
Predictors of pain and functional outcomes after operative treatment for rotator cuff tears <sup>24</sup>	Aug-18	Jain et al	Cohort study	Level 2 Outcome	50	RCR patients aged 45+ years with 4+ weeks of symptomatic RCT	Highest level of education	Highest level of education: $P = .79$ ; $P = .38$ adjusted for interaction with follow-up duration	Highest level of education was not a predictor of postoperative pain and function.

SES, socioeconomic status; CI, confidence interval; IQR, interquartile range; MDE, Medicaid dual-eligible; ± mean with standard deviation; ASES, American Shoulder and Elbow Surgeons; PSS, Penn Shoulder Score; SSV, Subjective Shoulder Score; RCR, rotator cuff repair; RCT, rotator cuff tear; PT, physical therapy. Effect size interpretation: 0-0.1 = no effect, 0.2-0.04 = small effect, 0.5-0.7 = intermediate effect, ≥0.8 = large effect; positive values denote a greater effect in the Medicaid group, and negative values denote a greater effect in the non-Medicaid group.<sup>48</sup>

<sup>1</sup>Insurance was used as a proxy for patient income.

<sup>2</sup>In addition to insurance, other income measures were done.

<sup>3</sup>Participant total does not include nonrespondents.

<sup>4</sup>Reference to Caucasian. C: Caucasian, AA: African American, H: Hispanic, A: Asian, NA: Native American.

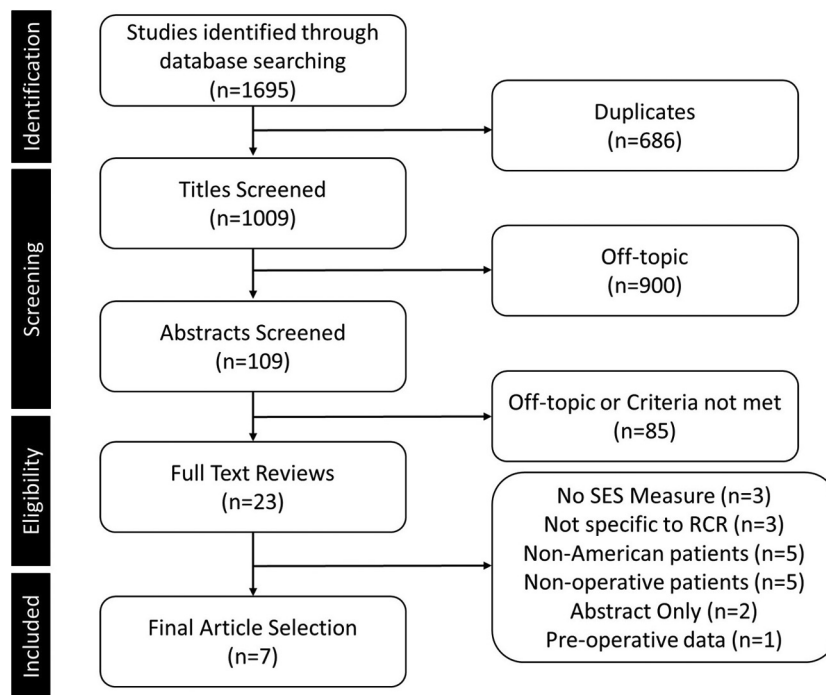


Figure 1 Flow chart of the identification of included studies. SES, socioeconomic status; RCR, rotator cuff repair.

to represent individual income; in addition, Li et al<sup>30</sup> recorded race and regional income. Jain et al<sup>24</sup> recorded the highest level of education. Specific outcome measures differed across these 3 studies. Sabesan et al<sup>48</sup> and Jain et al<sup>24</sup> utilized self-reported pain and functional evaluations, whereas Li et al<sup>30</sup> used hospital records.

Li et al<sup>30</sup> correlated low volume with poor outcomes. The authors noted that surgeon volume was previously shown to be inversely correlated with operative time, readmission rates, and cost, whereas facility volume is inversely correlated with revision rates, mortality rates, complication rates, and length of stay. In this study, they added that low-volume facilities and surgeons experienced higher readmission rates. Sabesan et al<sup>48</sup> found that non-Medicaid groups had a better average improvement in functional outcome scores. Although not statistically significant, the effect size calculations revealed small to large effects favoring the non-Medicaid patients. Medicaid patients had slightly worse improvement in range of motion, improving only in forward flexion, whereas non-Medicaid patients improved in forward flexion and abduction; neither cohort significantly improved in external

rotation. In aiming to determine predictors of pain and functional outcome scores for rotator cuff repair, Jain et al<sup>24</sup> found that the patient’s highest level of education did not have a significant impact on outcomes, even when assessed for interaction with follow-up duration (Table II).

Assessing cumulative risk of bias in this group of articles, 6 of 7 studies use insurance status as a proxy for income as a measure of SES. Of the SES measures defined by this review, occupation and employment were not used in any studies, and the highest level of education was only used in one study. Furthermore, selection bias is prevalent in at least 6 of 7 studies, as population pools are limited to regions and population types (ie, urban and age; Table II).

**Discussion**

This scoping literature review summarizes disparities in access to rotator cuff tear and associated outcomes for lower-SES patients. Although several reviews observe the impact of SES on orthopedic conditions, ours is the first to our knowledge to examine the impact

**Table III**  
Risk of bias assessment.

Authors	Study design	Level of evidence	Selection		Comparability		Outcome		Quality	Comment
			Representativeness of the sample (+)	Sample size (+)	Nonrespondents exposure (++)	Ascertainment of exposure (++)	Based on design and analysis (++)	Assessment of outcome (++)		
Rogers et al <sup>44</sup>	Cross-sectional	Level 4	+	+	+	+	++	+	5/10	Selection Bias: metropolitan, Medicaid expansion state
Li et al <sup>30</sup>	Cross-sectional	Level 4	+	+	++	++	++	+	8/10	Large sample size
Patterson et al <sup>39</sup>	Cross-sectional	Level 4	+	+	++	++	++	+	6/10	Selection bias: North Carolina
Curry et al <sup>12</sup>	Cross-sectional	Level 4	+	+	+	+	++	+	6/10	Selection bias: urban populations
Authors	Study design	Level of evidence	Selection		Comparability		Outcome		Quality	Comment
			Representativeness of the exposed cohort (+)	Selection of the nonexposed cohort (+)	Ascertainment of exposure (+)	Outcome not present before study (+)	Based on design and analysis (++)	Assessment of outcome (++)	Follow-up length (+)	Follow-up cohort (+)
Sabesan et al <sup>48</sup>	Retrospective cohort	Level 3	+	+	+	+	+	+	7/9	Small cohort
Jain et al <sup>24</sup>	Cohort	Level 2	+	+	+	+	+	*	5/9	30% dropout rate
Chapman et al <sup>8</sup>	Retrospective cohort	Level 3	+	+	+	+	++	+	9/9	Satisfactory Selection bias: narrow definition for RCT, Medicare only

RCT, rotator cuff tear.  
 Top: Newcastle Ottawa Scale adjusted for cross-sectional studies<sup>29</sup>; excellent = 9-10, good = 7-8, satisfactory = 5-6, unacceptable = 1-4. Bottom: Newcastle Ottawa Scale for cohort studies<sup>61</sup>; excellent = 8-9, good = 6-7, satisfactory = 4-5, unacceptable = 1-3.

on cuff repair. Despite the known relationship between outcomes of orthopedic injuries and procedures and SES, only 7 of 1009 studies recorded measures relevant to assessing the relationship between SES and cuff repair. The included studies assessed SES by measures of low income, minority race, and low-level education; no study included measures of occupation or employment. Overall, both access to care and rotator cuff repair outcomes were worse for patients of low SES based on income and specific patient race and ethnicity.

It is important to underscore the close relationship between access and outcome for rotator cuff repair. In studies by Rogers et al<sup>44</sup> and Patterson et al<sup>39</sup> Medicaid patients experienced longer wait times for appointments for physical therapy and orthopedic consult, respectively. In addition, patients in the study by Curry et al<sup>12</sup> were offered fewer appointments for care. Although optimal timing for physical therapy is under debate,<sup>11</sup> several studies indicate that delays in rehabilitation prolong recovery in pain, range of motion, and functional scores.<sup>46</sup> This prolongation of disability should be considered in the total cost of cuff repair, which augments the burden of disease specifically in low-SES patients.<sup>33</sup> This increased burden may deter low-SES patients from future care.<sup>27</sup> Furthermore, cuff tears with delayed repair develop greater atrophy and fatty infiltration which may correlate to higher retear rates and poorer functional outcomes.<sup>17,20,49,60</sup> Although many factors interact, this research adds to the inference that reduced access can reasonably lead to significant delays in care, thus worse outcomes.

Of the possible factors impacting the relationship between SES and health care, regional characteristics are noted in several studies. On a nationwide level, Curry et al<sup>12</sup> show that low-SES patients were more likely to be accepted for appointments within Medicaid expansion states. In addition, patients in the West had higher rates of acceptance, followed by the Midwest, the Northeast, and, finally, the South. Curry et al<sup>12</sup> also found that wait time difference for Medicaid patients is insignificant on a national average, although Rogers et al<sup>44</sup> find that wait times are longer for Medicaid patients in the greater Boston area, suggesting a high likelihood of local influences. Variability in findings such as these makes it difficult to apply conclusions locally and present as a challenge to future research. Providers should dynamically integrate this information with competent understanding of the unique influences in their practicing community. Aiming to compare urban and rural populations, Patterson et al<sup>40</sup> conducted a follow-up study in 2014. In this study, Medicaid acceptance rates were compared for cuff repair, acute flexor tendon laceration, and lumbar disc herniation patients, based on county population size. Physical therapy clinics in less populated, rural counties of North Carolina (ie, <250,000) were more likely to offer appointments to Medicaid patients than practices in more populated, urban counties (ie, >250,000). These findings imply that specifically urban, lower-SES patients may experience more difficulty in finding cuff repair care and may even be pushed to lower-volume hospitals, as seen in the study by Li et al.<sup>30</sup> Patterson et al<sup>39</sup> hypothesize that higher competition in populous areas motivates practices to accept fewer Medicaid patients, in favor of those with private insurance.

Medicaid reimbursement is mentioned in three articles as a contributing factor to reduced access to cuff repair care for low-SES patients. Li et al<sup>30</sup> directly blame low reimbursement rates for reduced access to high-volume surgeons among Medicaid patients. Patterson et al<sup>39</sup> note that although Medicaid reimbursement rates have a direct correlation with reduced access, the magnitude of this effect may differ depending on a state's unique reimbursement rate. Both articles suggest that raising reimbursement rates for cuff repair will improve access to care. Curry

et al<sup>12</sup> agree with this sentiment but also call attention to unique mechanisms by which Medicaid patients are restricted. In Virginia and Oklahoma, for example, Medicaid was only accepted at hospitals and not outpatient physical therapy clinics. In addition, in Maine and Washington, physical therapy practices stated that they were limited to only two Medicaid patients per practice at a time. While these restrictions likely stem from low reimbursement rates, other methods, such as eliminating state-by-state Medicaid differences,<sup>7</sup> may exist to improve suboptimal access.

Postulating the reason for worse cuff repair outcomes among low-SES patients appears to pose a greater challenge. Li et al<sup>30</sup> provide some possible explanation, demonstrating that these patients are directed to low-volume surgeons and facilities, which empirically deliver worse outcomes by increased readmission and complication rates. Several others also find that low-SES patients frequent low-volume hospitals for total joint arthroplasties because of restricted referral networks.<sup>19,55</sup> Despite these findings, the true degree of effect on outcomes appears unclear. Sabesan et al<sup>48</sup> find that functional outcomes are worse for low-SES patients; however, Jain et al<sup>24</sup> do not find significant disparity when the highest education level is used as the measure. This variance highlights the reality that health care disparity is a complex problem, not easily explained by small-scale studies. Elements of SES likely have effects both individually and in combination. The multidimensional nature of SES must be appreciated as a dynamic influence, but doing so is marred by challenges.<sup>22,52</sup> One of these challenges has been attaining precise and reliable measures on various population levels.<sup>52</sup>

The small group of eligible articles in this review is a product of this challenge. Health records have been historically limited in recording data pertaining to social determinants of health.<sup>3</sup> However, developments in electronic and personal health records are making information, such as SES determinants, more attainable.<sup>3,43</sup> Electronic records are showing benefit to clinical outcomes and goals in population health.<sup>3,6,26</sup> The hope is that as the capabilities and use of electronic health records expand in magnitude, so can the research toward understanding socioeconomic determinants of orthopedic care. While SES may be commonly neglected in investigating the quality of care for cuff repair, indicated by the few articles in this review, increasing amounts of data via electronic health records should be cause for integrating and exploring these data in future research.

This review on cuff repair access and outcomes joins others in highlighting SES-related disparities for common orthopedic conditions. Ezomo et al<sup>16</sup> utilized a national database to examine racial and ethnic disparities in total hip arthroplasty. In over 150,000 cases, African Americans and Hispanics were more likely to experience longer postoperative length of stays and higher rates of adverse events. A systematic review by Goodman et al<sup>21</sup> found that African Americans undergoing total knee arthroplasty experienced worse postoperative pain, function, satisfaction, and quality of life than Caucasian patients. Another review by Truong et al<sup>57</sup> indicated low SES as a relevant predictor of reduced function after distal radius fracture. With these consistent findings, it is clear that suboptimal care persists as a result of SES disparity. Although race is a commonly cited measure in orthopedic studies,<sup>50</sup> several SES factors likely have an influence and should be considered, both collectively and individually, in future studies.

This study has several limitations. First, while we sought to examine all defined SES factors, insurance status as a proxy for income was the predominant measure of the reviewed studies. We acknowledge that this omits a large population within the low-SES community as nearly 11% of Americans are uninsured, most of which are low-income and minority people.<sup>56</sup> Second, certain measures of race and ethnicity are commonly measured and may

not be noted in a study title and abstract. Thus, articles of this nature may have not been discovered in our search. Our search adequately captured articles in which SES measures were highlighted for clinical relevance. Finally, SES is a fluid term and may be presented with several definitions and measures that differ from that used in this review. Our definition is reliable as we used two large governing bodies, the American Psychologic Association and the US Department of Justice, to determine appropriate measures of SES.<sup>1,4</sup>

## Conclusion

The results of this scoping review demonstrate that patients of low SES face reduced access to cuff repair care and worse associated outcomes. The present research limits specific conclusions about the influence of SES on cuff repair, although it demands further investigation.

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## References

1. American Psychological Association, Task Force on Socioeconomic Status. Report of the APA Task Force on Socioeconomic Status. American Psychological Association. Available at: <https://www.apa.org/pi/ses/resources/publications/task-force-2006.pdf>; 2007. Accessed February 18, 2021.
2. Andresen EM, Miller DK. The future (history) of socioeconomic measurement and implications for improving health outcomes among African Americans. *J Gerontol A Biol Sci Med Sci* 2005;60:1345-50. <https://doi.org/10.1093/geron/60.10.1345>.
3. Bazemore AW, Cottrell EK, Gold R, Hughes LS, Phillips RL, Angier H, et al. "Community vital signs": incorporating geocoded social determinants into electronic records to promote patient and population health. *J Am Med Inform Assoc* 2016;23:407-12. <https://doi.org/10.1093/jamia/ocv088>.
4. Berzofsky M, Smiley-McDonald H, Moore A, Krebs C. Measuring Socioeconomic Status (SES) in the NCVS: Background, Options, and Recommendations. Bureau of Justice Statistics, U.S. Department of Justice. Available at: <https://www.ojp.gov/pdffiles1/bjs/grants/248562.pdf>; 2014. Accessed February 18, 2021.
5. Blumenthal D, Abrams M, Nuzum R. The Affordable Care Act at 5 Years. *N Engl J Med* 2015;372:2451-8. <https://doi.org/10.1056/NEJMp1503614>.
6. Cantor MN, Thorpe L. Integrating Data On Social Determinants Of Health Into Electronic Health Records. *Health Aff (Millwood)* 2018;37:585-90. <https://doi.org/10.1377/hlthaff.2017.1252>.
7. Casper DS, Schroeder GD, McKenzie J, Zmstowski B, Vatson J, Mangan J, et al. Medicaid Reimbursement for Common Spine Procedures: Are Compensation Rates Consistent? *Spine (Phila Pa 1976)* 2019;44:1585-90. <https://doi.org/10.1097/BRS.0000000000003241>.
8. Chapman CG, Floyd SB, Thigpen CA, Tokish JM, Chen B, Brooks JM. Treatment for Rotator Cuff Tear Is Influenced by Demographics and Characteristics of the Area Where Patients Live. *JB JS Open Access* 2018;3:e0005. <https://doi.org/10.2106/JBJS.OA.18.00005>.
9. Cho CH, Song KS, Hwang I, Warner JJ. Does Rotator Cuff Repair Improve Psychologic Status and Quality of Life in Patients With Rotator Cuff Tear? *Clin Orthop Relat Res* 2015;473:3494-500. <https://doi.org/10.1007/s11999-015-4258-1>.
10. Chung SW, Park JS, Kim SH, Shin SH, Oh JH. Quality of life after arthroscopic rotator cuff repair: evaluation using SF-36 and an analysis of affecting clinical factors. *Am J Sports Med* 2012;40:631-9. <https://doi.org/10.1177/0363546511430309>.
11. Conti M, Garofalo R, Delle Rose G, Massazza G, Vinci E, Randelli M, Castagna A. Post-operative rehabilitation after surgical repair of the rotator cuff. *Chir Organi Mov* 2009;93:S55-63. <https://doi.org/10.1007/s12306-009-0003-9>.
12. Curry EJ, Penvose I, Knapp B, Parisien RL, Li X. National Disparities in Access to Physical Therapy After Rotator Cuff Repair Between Patients with Medicaid versus Private Health Insurance. *JSES Int* 2021;5:507-11. <https://doi.org/10.1016/j.jseint.2020.11.006>.

13. D'Apuzzo MR, Villa JM, Alcerro JC, Rossi MD, Lavernia CJ. Total Joint Arthroplasty: A Granular Analysis of Outcomes in the Economically Disadvantaged Patient. *J Arthroplasty* 2016;31:41-4. <https://doi.org/10.1016/j.arth.2016.02.066>.
14. Draeger RW, Patterson BM, Olsson EC, Schaffer A, Patterson JM. The influence of patient insurance status on access to outpatient orthopedic care for flexor tendon lacerations. *J Hand Surg Am* 2014;39:527-33. <https://doi.org/10.1016/j.jhssa.2013.10.031>.
15. Dy CJ, Barker AR, Brown DS, Keller M, Chang P, Yamaguchi K, et al. Unmet Need for Total Joint Arthroplasty in Medicaid Beneficiaries After Affordable Care Act Expansion. *J Bone Joint Surg Am* 2020;102:1495-500. <https://doi.org/10.2106/JBJS.20.00125>.
16. Ezomo OT, Sun D, Gronbeck C, Harrington MA, Halawi MJ. Where Do We Stand Today on Racial and Ethnic Health Disparities? An Analysis of Primary Total Hip Arthroplasty From a 2011-2017 National Database. *Arthroplast Today* 2020;6: 872-6. <https://doi.org/10.1016/j.artd.2020.10.002>.
17. Fu MC, O'Donnell EA, Taylor SA, Aladesuru OM, Rauck RC, Dines JS, et al. Delay to Arthroscopic Rotator Cuff Repair Is Associated With Increased Risk of Revision Rotator Cuff Surgery. *Orthopedics* 2020;43:340-4. <https://doi.org/10.3928/01477447-20200923-02>.
18. Galatz LM, Ball CM, Teefey SA, Middleton WD, Yamaguchi K. The outcome and repair integrity of completely arthroscopically repaired large and massive rotator cuff tears. *J Bone Joint Surg Am* 2004;86:219-24. <https://doi.org/10.2106/00004623-200402000-00002>.
19. Ghomrawi HMK, Funk RJ, Parks ML, Owen-Smith J, Hollingsworth JM. Physician referral patterns and racial disparities in total hip replacement: A network analysis approach. *PLoS One* 2018;13:e0193014. <https://doi.org/10.1371/journal.pone.0193014>.
20. Gladstone JN, Bishop JY, Lo IK, Flatow EL. Fatty infiltration and atrophy of the rotator cuff do not improve after rotator cuff repair and correlate with poor functional outcome. *Am J Sports Med* 2007;35:719-28. <https://doi.org/10.1177/0363546506297539>.
21. Goodman SM, Parks ML, McHugh K, Fields K, Smethurst R, Figgie MO, et al. Disparities in Outcomes for African Americans and Whites Undergoing Total Knee Arthroplasty: A Systematic Literature Review. *J Rheumatol* 2016;43:765-70. <https://doi.org/10.3899/jrheum.150950>.
22. Haghdoust AA. Complexity of the socioeconomic status and its disparity as a determinant of health. *Int J Prev Med* 2012;3:75-6.
23. Herzog R, Álvarez-Pasquín MJ, Díaz C, Del Barrio JL, Estrada JM, Gil Á. Are healthcare workers' intentions to vaccinate related to their knowledge, beliefs and attitudes? A systematic review. *BMC Public Health* 2013;13:154. <https://doi.org/10.1186/1471-2458-13-154>.
24. Jain NB, Ayers GD, Fan R, Kuhn JE, Baumgarten KM, Matzkin E, et al. Predictors of pain and functional outcomes after operative treatment for rotator cuff tears. *J Shoulder Elbow Surg* 2018;27:1393-400. <https://doi.org/10.1016/j.jse.2018.04.016>.
25. Khatana SAM, Bhatla A, Nathan AS, Giri J, Shen C, Kazi DS, et al. Association of Medicaid Expansion With Cardiovascular Mortality [published correction appears in *JAMA Cardiol*. 2019 Jul 1;4(7):714]. *JAMA Cardiol* 2019;4:671-9. <https://doi.org/10.1001/jamacardio.2019.1651>.
26. King J, Patel V, Jamoom EW, Furukawa MF. Clinical benefits of electronic health record use: national findings. *Health Serv Res* 2014;49:392-404. <https://doi.org/10.1111/1475-6773.12135>.
27. Kullgren JT, Galbraith AA, Hinrichsen VL, Miroshnik I, Penfold RB, Rosenthal MB, et al. Health care use and decision making among lower-income families in high-deductible health plans. *Arch Intern Med* 2010;170:1918-25. <https://doi.org/10.1001/archinternmed.2010.428>.
28. Labrum JT 4th, Paziuk T, Rihn TC, Hilibrand AS, Vaccaro AR, Maltenfort MG, et al. Does Medicaid Insurance Confer Adequate Access to Adult Orthopaedic Care in the Era of the Patient Protection and Affordable Care Act? *Clin Orthop Relat Res* 2017;475:1527-36. <https://doi.org/10.1007/s11999-017-5263-3>.
29. Lee J, Callaghan T, Ory M, Zhao H, Bolin JN. The Impact of Medicaid Expansion on Diabetes Management. *Diabetes Care* 2020;43:1094-101. <https://doi.org/10.2337/dc19-1173>.
30. Li L, Bokshan SL, Mehta SR, Owens BD. Disparities in Cost and Access by Caseload for Arthroscopic Rotator Cuff Repair: An Analysis of 18,616 Cases. *Orthop J Sports Med* 2019;7:2325967119850503. <https://doi.org/10.1177/2325967119850503>.
31. Lieber AM, Boniello AJ, Kerbel YE, Petrucelli P, Kavuri V, Jakoi A, et al. Low Socioeconomic Status Is Associated With Increased Complication Rates: Are Risk Adjustment Models Necessary in Cervical Spine Surgery? *Glob Spine J* 2020;10:748-53. <https://doi.org/10.1177/2192568219874763>.
32. Loehrer AP, Chang DC, Scott JW, Hutter MM, Patel VI, Lee JE, et al. Association of the Affordable Care Act Medicaid Expansion With Access to and Quality of Care for Surgical Conditions. *JAMA Surg* 2018;153:e175568. <https://doi.org/10.1001/jamasurg.2017.5568>.
33. Lubetkin EI, Jia H. Burden of disease associated with lower levels of income among US adults aged 65 and older. *BMJ Open* 2017;7:e013720. <https://doi.org/10.1136/bmjopen-2016-013720>.
34. Makhni EC, Swart E, Steinhaus ME, Mather RC 3<sup>rd</sup>, Levine WN, Bach BR Jr, et al. Cost-Effectiveness of Reverse Total Shoulder Arthroplasty Versus Arthroscopic Rotator Cuff Repair for Symptomatic Large and Massive Rotator Cuff Tears. *Arthroscopy* 2016;32:1771-80. <https://doi.org/10.1016/j.arthro.2016.01.063>.
35. Manoso MW, Cizik AM, Bransford RJ, Bellabarba C, Chapman J, Lee MJ. Medicaid status is associated with higher surgical site infection rates after spine surgery. *Spine (Phila Pa 1976)* 2014;39:1707-13. <https://doi.org/10.1097/BRS.0000000000000496>.
36. Marrero CE, Igbokwe LI, Leonardi C. Access to Orthopedic Care post Medicaid Expansion Through the Affordable Care Act. *J Natl Med Assoc* 2019;111:148-52. <https://doi.org/10.1016/j.jnma.2018.07.005>.
37. Mather RC 3<sup>rd</sup>, Koenig L, Acevedo D, Dall TM, Gallo P, Romeo A, et al. The societal and economic value of rotator cuff repair. *J Bone Joint Surg Am* 2013;95:1993-2000. <https://doi.org/10.2106/JBJS.L.01495>.
38. Medicaid.gov. Medicaid & CHIP Enrollment Data Highlights. Centers for Medicare & Medicaid Services. Available at: <https://www.medicaid.gov/medicaid/program-information/medicaid-and-chip-enrollment-data/report-highlights/index.html>; 2021. Accessed April 1, 2021.
39. Patterson BM, Spang JT, Draeger RW, Olsson EC, Creighton RA, Kamath GV. Access to outpatient care for adult rotator cuff patients with private insurance versus Medicaid in North Carolina. *J Shoulder Elbow Surg* 2013;22:1623-7. <https://doi.org/10.1016/j.jse.2013.07.051>.
40. Patterson BM, Draeger RW, Olsson EC, Spang JT, Lin FC, Kamath GV. A regional assessment of medicaid access to outpatient orthopaedic care: the influence of population density and proximity to academic medical centers on patient access. *J Bone Joint Surg Am* 2014;96:e156. <https://doi.org/10.2106/JBJS.M.01188>.
41. Pierce TR, Mehlman CT, Tamai J, Skaggs DL. Access to care for the adolescent anterior cruciate ligament patient with Medicaid versus private insurance. *J Pediatr Orthop* 2012;32:245-8. <https://doi.org/10.1097/BPO.0b013e31824abf20>.
42. Präg P, Mills MC, Wittek R. Subjective socioeconomic status and health in cross-national comparison. *Soc Sci Med* 2016;149:84-92. <https://doi.org/10.1016/j.socscimed.2015.11.044>.
43. Roehrs A, da Costa CA, Righi RD, de Oliveira KS. Personal Health Records: A Systematic Literature Review. *J Med Internet Res* 2017;19:e13. <https://doi.org/10.2196/jmir.5876>.
44. Rogers MJ, Penvose I, Curry EJ, Galvin JW, Li X. Insurance status affects access to physical therapy following rotator cuff repair surgery: A comparison of privately insured and Medicaid patients. *Orthop Rev (Pavia)* 2019;11:7989. <https://doi.org/10.4081/or.2019.7989>.
45. Rosenbaum S. The Patient Protection and Affordable Care Act: implications for public health policy and practice. *Public Health Rep* 2011;126:130-5. <https://doi.org/10.1177/003335491112600118>.
46. Ross D, Maerz T, Lynch J, Norris S, Baker K, Anderson K. Rehabilitation following arthroscopic rotator cuff repair: a review of current literature. *J Am Acad Orthop Surg* 2014;22:1-9. <https://doi.org/10.5435/JAAOS-22-01-1>.
47. Rudowitz R, Antonisse L. Implications of the ACA Medicaid Expansion: A Look at the Data and Evidence. Kaiser Family Foundation. Available at: <https://www.kff.org/medicaid/issue-brief/implications-of-the-aca-medicaid-expansion-a-look-at-the-data-and-evidence/>; 2018. Accessed April 1, 2021.
48. Sabesan V, Whaley J, Petersen-Fitts G, Sherwood A, Sweet M, Lima DJL, et al. The effect of Medicaid payer status on patient outcomes following repair of massive rotator cuff tears. *Musculoskelet Surg* 2018;102:267-72. <https://doi.org/10.1007/s12306-017-0528-2>.
49. Sambandan SN, Khanna V, Gul A, Mounasamy V. Rotator cuff tears: An evidence based approach. *World J Orthop* 2015;6:902-18. <https://doi.org/10.5312/wjo.v6.i11.902>.
50. Schoenfeld AJ, Tipirneni R, Nelson JH, Carpenter JE, Iwashyna TJ. The influence of race and ethnicity on complications and mortality after orthopedic surgery: a systematic review of the literature. *Med Care* 2014;52:842-51. <https://doi.org/10.1097/MLR.0000000000000177>.
51. Semega J, Kollar M, Shrider EA, Creamer JF. Income and Poverty in the United States: 2019. US Census Bureau. Available at: <https://www.census.gov/library/publications/2020/demo/p60-270.html>; 2020. Accessed April 1, 2021.
52. Shavers VL. Measurement of socioeconomic status in health disparities research. *J Natl Med Assoc* 2007;99:1013-23.
53. Skaggs DL, Clemens SM, Vitale MG, Femino JD, Kay RM. Access to orthopedic care for children with medicaid versus private insurance in California. *Pediatrics* 2001;107:1405-8.
54. Skaggs DL, Lehmann CL, Rice C, Killelea BK, Bauer RM, Kay RM, et al. Access to orthopaedic care for children with medicaid versus private insurance: results of a national survey. *J Pediatr Orthop* 2006;26:400-4. <https://doi.org/10.1097/01.bpo.0000217715.87857.24>.
55. Soohoo NF, Lieberman JR, Fargn E, Park S, Jain S, Ko CY. Perioperative quality-of-care measures for patients undergoing total hip or total knee replacement. *J Long Term Eff Med Implants* 2009;19:249-53. <https://doi.org/10.1615/jlongtermeffmedimplants.v19.i4.10>.
56. Tolbert J, Orgera K, Damico A. Key Facts about the Uninsured Population. Kaiser Family Foundation. Available at: <https://www.kff.org/uninsured/issue-brief/key-facts-about-the-uninsured-population/>; 2020. Accessed April 1, 2021.
57. Truong JL, Doherty C, Suh N. The Effect of Socioeconomic Factors on Outcomes of Distal Radius Fractures: A Systematic Review. *Hand (NY)* 2018;13:509-15. <https://doi.org/10.1177/1558944717735945>.
58. United States Census Bureau. U.S. Census Bureau Releases New Educational Attainment Data. US Department of Commerce. Available at: <https://www.census.gov/newsroom/press-releases/2020/educational-attainment.html>; 2020. Accessed April 1, 2021.
59. Waldrop LD 2<sup>nd</sup>, King JJ 3<sup>rd</sup>, Mayfield J, Farmer KW, Struk AM, Wright TW, et al. The effect of lower socioeconomic status insurance on outcomes after



- primary shoulder arthroplasty. *J Shoulder Elbow Surg* 2018;27:S35–42. <https://doi.org/10.1016/j.jse.2018.01.002>.
60. Wang Z, Liu X, Davies MR, Horne D, Kim H, Feeley BT. A Mouse Model of Delayed Rotator Cuff Repair Results in Persistent Muscle Atrophy and Fatty Infiltration. *Am J Sports Med* 2018;46:2981–9. <https://doi.org/10.1177/0363546518793403>.
61. Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, Tugwell P. The Newcastle-Ottawa Scale (NOS) for assessing the quality if nonrandomized studies in meta-analyses. Ottawa Hosp Res Inst. Available at: [http://www.ohri.ca/programs/clinical\\_epidemiology/oxford.htm](http://www.ohri.ca/programs/clinical_epidemiology/oxford.htm). Accessed March 19, 2021.
62. Williamson TR, Paoli AR, Hutzler L, Zuckerman J, Bosco J 3rd. Access to Elective Orthopaedic Surgery After the Affordable Care Act Medicaid Expansion: The New York State Experience. *J Am Acad Orthop Surg* 2020;28:e158–63. <https://doi.org/10.5435/JAAOS-D-18-00062>.
63. Wiznia DH, Nwachuku E, Roth A, Kim CY, Save A, Anandasivam NS, et al. The Influence of Medical Insurance on Patient Access to Orthopaedic Surgery Sports Medicine Appointments Under the Affordable Care Act. *Orthop J Sports Med* 2017;5:2325967117714140. <https://doi.org/10.1177/2325967117714140>.
64. Yamaguchi K, Ditsios K, Middleton WD, Hildebolt CF, Galatz LM, Teefey SA. The demographic and morphological features of rotator cuff disease. A comparison of asymptomatic and symptomatic shoulders. *J Bone Joint Surg Am* 2006;88:1699–704. <https://doi.org/10.2106/JBJS.E.00835>.
65. Yamamoto A, Takagishi K, Osawa T, Yanagawa T, Nakajima D, Shitara H, et al. Prevalence and risk factors of a rotator cuff tear in the general population. *J Shoulder Elbow Surg* 2010;19:116–20. <https://doi.org/10.1016/j.jse.2009.04.006>.