

# Quality Measures in Orthopaedic Sports Medicine: A Systematic Review



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**Purpose:** To report the current quality measures that are applicable to orthopaedic sports medicine physicians. **Methods:** Six databases were searched with a customized search term to identify quality measures relevant to orthopaedic sports medicine surgeons: MEDLINE/PubMed, EMBASE, the National Quality Forum (NQF) Quality Positioning System (QPS), the Agency for Healthcare Research and Quality (AHRQ) National Quality Measures Clearinghouse (NQMC), the Physician Quality Reporting System (PQRS) database, and the American Academy of Orthopaedic Surgeons (AAOS) website. Results were screened by 2 Board-certified orthopaedic surgeons with fellowship training in sports medicine and dichotomized based on sports medicine—specific or general orthopaedic (nonarthroplasty) categories. Hip and knee arthroplasty measures were excluded. Included quality measures were further categorized based on Donabedian's domains and the Center for Medicare and Medicaid (CMS) National Quality Strategy priorities. **Results:** A total of 1,292 quality measures were screened and 66 unique quality measures were included. A total of 47 were sports medicine—specific and 19 related to the general practice of orthopaedics for a fellowship-trained sports medicine specialist. Nineteen (29%) quality measures were collected within PQRS, with 5 of them relating to sports medicine and 14 relating to general orthopaedics. AAOS Clinical Practice Guidelines (CPGs) comprised 40 (60%) of the included measures and were all within sports medicine. Five (8%) additional measures were collected within AHRQ and 2 (3%) within NQF. Most quality measures consist of process rather than outcome or structural measures. No measures addressing concussions were identified. **Conclusions:** There are many existing quality measures relating to the practice of orthopaedic sports medicine. Most quality measures are process measures described within PQRS or AAOS CPGs. **Clinical Relevance:** Knowledge of quality measures are important as they may be used to improve care, are increasingly being used to determine physician reimbursement, and can inform future quality measure development efforts.

To contain the continued rise in health care costs, there has been a focus by payers to shift the behavior of individual physicians, as well as large health

care systems, through financial incentive.<sup>1,2</sup> With the passage of the United States Patient Protection and Affordable Care Act (ACA), techniques of behavioral economics are increasingly linking financial incentives to the provision of high-quality health care,<sup>3</sup> defined as the degree to which health care services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge.<sup>4</sup>

According to the Centers for Medicare and Medicaid Services (CMS), quality health care centers around providing effective, safe, efficient, patient-centered, equitable, and timely care.<sup>5</sup> Specifically, the Department of Health & Human Services, through the National Quality Strategy, has described 6 priorities for improving health care quality: person- and caregiver-centered experience and outcomes, patient safety, communication and care coordination, community and population-based health, efficiency and cost reduction, and effective clinical care.<sup>6</sup>

One method to evaluate whether physicians and health systems are providing quality health care is

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**Table 1.** Customized Search Term Used for Medline/PubMed for Quality Measures Related to Sports Medicine

("Quality Indicators, Health Care" [mesh:noexp] OR "Quality Improvement" [mesh:noexp] OR "quality control" [mesh:noexp] OR "appropriate use" [tiab] OR "practice guideline" [tiab] OR Guideline[ptyp] OR "Practice Guideline"[ptyp] OR "quality" [ti] OR "quality assessment" [tiab] OR "outcome assessment" [tiab] OR "quality assessments" [tiab] OR "outcome assessments" [tiab] OR "quality measure" [tiab] OR "quality metric" [tiab] OR "quality indicator" [tiab] OR "quality indicators" [tiab] OR "performance measure" [tiab] OR "performance metric" [tiab] OR "performance indicator" [tiab] OR "performance measures" [tiab] OR "performance metrics" [tiab] OR "performance indicators" [tiab] OR "quality metrics" [tiab] OR "quality improvement" [tiab] OR "quality measurements" [tiab] AND ("Anterior Cruciate Ligament"[Mesh] OR "Anterior Cruciate Ligament"[ti] OR "ACL"[ti] OR "Arthroscopy"[Mesh] OR "arthroscopy"[ti] OR "biceps"[ti] OR "Cartilage"[Mesh] OR "cartilage"[ti] OR "Brain Concussion"[Mesh] OR "concussion"[ti] OR "Elbow"[Mesh] OR "elbow"[ti] OR "Femoracetabular Impingement"[Mesh] OR "Femoracetabular Impingement"[ti] OR "Hip"[Mesh] OR "hip"[ti] OR "impingement"[ti] OR "Joint Instability"[Mesh] OR "instability"[ti] OR "Knee"[Mesh] or "knee"[ti] OR "labrum"[ti] OR "Ligaments, Articular"[Mesh] OR "ligament"[ti] OR "Menisci, Tibial"[Mesh] OR "meniscus"[ti] OR "microfracture"[ti] OR "Osteochondritis Dissecans"[Mesh] OR "osteochondritis dissecans"[ti] OR "Return to Sport"[Mesh] OR "Return to sport"[ti] OR "Rotator Cuff"[Mesh] OR "rotator cuff"[ti] OR "Shoulder"[Mesh] OR shoulder[ti] OR "Sports"[ti] OR "sports medicine"[ti]) AND (surgery [sh] OR "surgical"[ti] OR surgery [ti] OR operat\*[ti]) AND english [lang] NOT ("animals" [mesh] NOT "Humans" [mesh])

through the use of quality measures. Quality measures are tools that assist in the measurement of health care processes, outcomes, patient perceptions, and organizational structure associated with the provision of quality care.<sup>5</sup> Quality measures can be classified into 3 domains: structure, process, and outcome measures.<sup>7</sup> More specifically, structure measures relate to an organization’s capabilities to provide care (whether a particular facility is a designated Level I Trauma Center), process measures are metrics by which a health care–related activity performed for, on behalf of, or by a patient is measured (the administration of preoperative antibiotics in all surgical patients), and outcome measures relate to the evaluation of the health state of a patient resulting from health care (tracking the number of surgical site infections within the organization).

The importance of quality measures is evidenced by CMS’s use of these tools to adjust reimbursement on the basis of a physician’s reporting through the Physician Quality Reporting System (PQRS).<sup>8</sup> In addition to pay-for-reporting programs, quality measures can be used for quality improvement projects as well as public reporting such as on Hospital Compare<sup>9</sup> and Physician Compare.<sup>10</sup>

Knowledge of the current quality measures applicable to orthopaedic sports medicine offers the opportunity to

gain insight regarding criteria private and public payers may use to determine reimbursement, how payers and the public will judge physicians against their peers, and how health care providers and organizations can develop and implement quality improvement projects to provide the highest level of care to our patients. Understanding current quality measures that are applicable to orthopaedic sports medicine physicians can also inform future quality measure development efforts.

The purpose of this investigation is to report the current quality measures that are applicable to orthopaedic sports medicine physicians. Given that a majority of previously identified measures were process measures,<sup>11</sup> we hypothesized that the majority of quality measures identified in this systematic review would be also be process measures rather than structure or outcome measures.

**Methods**

We used methodology from the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) Statement in conducting this investigation.<sup>12</sup> MEDLINE/PubMed was searched (February 2016) using a customized search term (Table 1) created to identify quality measures related to the practice of orthopaedic sports medicine. Terms such as “quality,” “measure,” “improvement,” and “performance” were included with sports medicine–specific terms such as “shoulder,” “elbow,” “hip,” “knee,” “ankle,” “concussion,” and other sports medicine–specific diagnoses (Table 2). EMBASE was also searched using Scopus with this same criteria.

We also searched the National Quality Forum (NQF) Quality Positioning System (QPS), the Agency for Healthcare Research and Quality (AHRQ) National Quality Measures Clearinghouse (NQMC), and the PQRS databases using specific search terms (3). The performance of the search was slightly different than for MEDLINE/PubMed because these databases contain only quality measures. In searching these databases, only the items listed in Table 2 were queried.

**Table 2.** Search Terms Used in the Query of the Quality Measures Database

Achilles	Knee
Ankle	Labrum
Anterior cruciate ligament	Ligament
Arthroscopy	Meniscus
Biceps	Microfracture
Cartilage	Osteochondritis dissecans
Concussion	Return to sport
Elbow	Rotator cuff
Femoroacetabular impingement	Shoulder
Hip	Sport
Instability	

Additionally, the American Academy of Orthopaedic Surgeons (AAOS) website was queried to capture all measures relating to sports medicine, such as Clinical Practice Guidelines (CPG). Appropriate use criteria were excluded because they were not felt to be usable as quality measures. Quality measures, in contrast to appropriate use criteria, are constructed to address a gap in care and provide a clear definition (numerator/denominator) of how to evaluate a physician or health system's adherence to the measure, with the goal of improving care. We did not include appropriate use criteria because they do not address a gap in care and are not usable to construct a numerator and denominator for a quality measure to evaluate care.

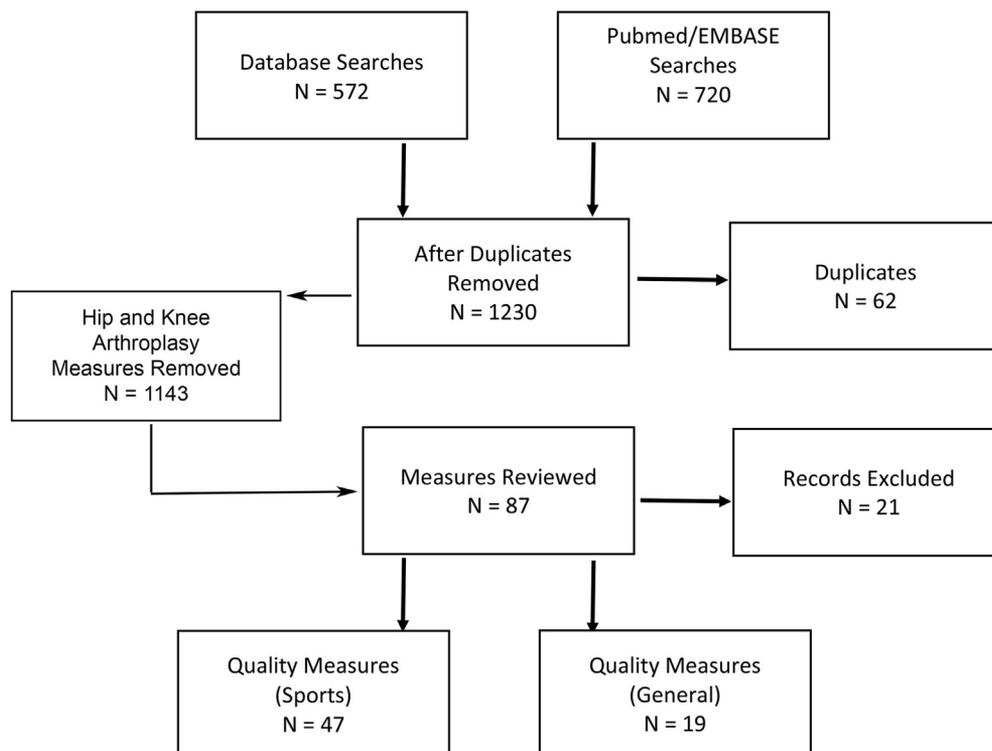
Two board-certified and fellowship-trained orthopaedic sports medicine surgeons (G.D.A. and M.R.S.) reviewed each one of the identified studies or quality measures. Disagreement between the initial 2 reviewers was resolved through review of a third board-certified and fellowship-trained orthopaedic sports medicine surgeon. Documents and measures were included if they related to the practice of orthopaedic sports medicine, defined as "operative and non-operative treatment of conditions relating to sports participation as well as other conditions of the shoulder, elbow, hip, knee, and ankle." The AAOS CPGs were included if they addressed a condition within sports medicine (as defined above) and were "strong," "moderate," or "consensus" recommendations. The inclusion of "moderate" recommendation CPGs (rather than only

"strong" or "consensus") were included to not limit the information provided to the reader. For completeness, measures identified in the quality measures databases using the described sports medicine search terms (Table 2) that related to the general practice of orthopaedic surgery and that a fellowship-trained sports medicine physician would treat were also screened for inclusion and reported separately. The only conditions excluded in the search results were those relating to hip and knee arthroplasty.

To further categorize our findings, included measures were categorized using Donabedian's domains of structure, process, and outcome.<sup>13,14</sup> Included quality measures were also classified based on the CMS National Quality Strategy priorities for reporting, as described above.<sup>6</sup> A  $\chi$ -square analysis was performed when comparing the number of quality measures categorized within Donabedian's domains.

## Results

The initial search algorithms identified a total of 1,292 quality measures and articles (Fig 1). Table 3 describes the databases used in the search. After review, a total of 66 unique quality measures were identified—47 determined to be sports medicine-specific (Tables 4 and 5) and 19 related to the general practice of orthopaedics for a fellowship-trained sports medicine specialist (Tables 6 and 7). Most measures were developed through literature review and the use of RAND/UCLA Appropriateness Methodology. Using a modified



**Fig 1.** Study inclusion PRISMA flow diagram.

**Table 3.** Databases Used to Identify Quality Measures

Name	Organization	Information Provided
American Academy of Orthopaedic Surgeons (AAOS) Clinical Practice Guidelines	Professional organization composed of orthopaedic surgeons	Evidence-based guidelines
Agency for Healthcare Research and Quality (AHRQ) National Quality Measures Clearinghouse (NQMC)	Division of the US Department of Health and Human Services (DHHS) responsible for providing metrics to improve the quality of care	Endorsed quality measures endorsed by the AHRQ developed by private or public organizations
Centers for Medicare & Medicaid Services (CMS) Physician Quality Reporting System (PQRS)	Division of DHHS responsible for administering Medicare and working with states to administer Medicaid.	Federally endorsed quality measures used for quality reporting and physician reimbursement
National Quality Forum (NQF) Quality Positioning System (QPS)	Nonprofit, private organization that endorses quality measures	Quality measures endorsed by the NQF developed by private or public organizations
MEDLINE/PubMed	US National Library of Medicine	Searchable database of life science references
EMBASE	Elsevier	Searchable database of life science references

Delphi process, this method allows for multiple rounds of independent ratings by a group of experts and has been shown to produce quality measures with face, construct, and predictive validity.<sup>15-17</sup>

Overall, there were 19 (29%) quality measures being collected within PQRS, with 5 of them relating to sports medicine and 14 relating to general orthopaedics. All of the sports medicine-specific PQRS measures received NQF endorsement. AAOS CPGs comprised 40 (60%) of the included measures and were all within sports medicine. Five (8%) additional measures were collected within AHRQ and 2 (3%) within NQF. A majority of the included measures (83%) were defined as process measures ( $P < .001$ ).

**AAOS CPGs**

A total of 96 CPGs were reviewed, with 40 included based on representing “strong,” “moderate,” or “consensus” recommendations. The subject matter for the included CPGs were treatment of Achilles tendon rupture (2009), anterior cruciate ligament (ACL) injuries (2014), glenohumeral joint osteoarthritis (2009), osteoarthritis of the knee (nonarthroplasty) (2013), osteochondritis dissecans (2010), and rotator cuff problems (2010). All CPGs were classified as process measures and addressed the effective clinical care priority from the National Quality Strategy.

**CMS PQRS**

A total of 19 PQRS measures were identified and included. Five of these were sports medicine-specific and all related to outcome measures centering on functional change for patients receiving treatment for joint-specific impairments. An additional 14 were related to general orthopaedics, with 11 process and 3 outcome measures. The sports medicine-specific measures all addressed communication and care coordination within the National Quality Strategy priorities whereas the general orthopaedic measures addressed patient safety (8), effective clinical care (5), communication and care coordination (3), and person- and

caregiver-centered experience and outcome (3). Endorsers included the AAOS, AHRQ, the American College of Surgeons, American Medical Association-Physician Consortium for Performance Improvement, CMS, Focus on Therapeutic Outcomes, National Committee for Quality Assurance, and Quality Insights of Pennsylvania.

**NQF**

A total of 2 unique NQF measures were identified, both relating to general orthopaedics. Five previously identified PQRS measures received NQF endorsement, all within the sports medicine measures. Each one of the identified NQF measures were outcome related and focused on either patient safety or clinical care and coordination. Endorsers included the Children’s Hospital of Philadelphia and Focus on Therapeutic Outcomes.

**AHRQ NQMC**

Five AHRQ NQMC measures were identified, with 2 relating to sports medicine and 3 for general orthopaedics. Four were process related and one was outcome related, with NQS domains of effective clinical care and patient safety. The endorsers included the AAOS, American College of Radiology, CMS, the Joint Commission, Institute for Clinical Systems Improvement, National Committee for Quality Assurance, and the Physician Consortium for Performance Improvement.

**Discussion**

This review identified 66 quality measures related to the practice of orthopaedic sports medicine. Most of the measures identified relating directly to a sports medicine surgeon were process measures (83%), with 17% being outcome measures. There were no structural measures identified. Most of the process measures were derived from AAOS CPGs.

Kamal et al.,<sup>18</sup> in a review of quality measures related to hand and upper limb surgery, reported that 98%

**Table 4.** Summary of Orthopaedic Sports Medicine—Specific Quality Measure Developers and Domains

Source	Developer	Development Methodology	Structure, Process, or Outcome	NQS Domains	No. of Measures	Topics
PQRS	Focus on Therapeutic Outcomes	Unknown	Outcome	CCC	5	Evaluating functional status change for patients with specific joint function impairments
AHRQ NQMC	ACR, NCQA, AMA PCPI	LR and EC	Process	PS (2) ECC (2)	2	Percentage of patients with advanced imaging (MRI/MRA) of the knee or shoulder who received plain radiographs of the joint in the preceding 3 months
AAOS CPG: Diagnosis and Treatment of Acute Achilles Tendon Rupture (2009)	AAOS	LR and EC	Process	ECC	4	Nonoperative, operative, and rehabilitation guidelines for the treatment of Achilles tendon injury
AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	AAOS, NASM, AOSSM, NATA, AAPM&R	LR and EC	Process	ECC	13	Nonoperative, operative, and rehabilitation guidelines for the treatment of anterior cruciate ligament injury
AAOS CPG: Treatment of Glenohumeral Joint Osteoarthritis (2009)	AAOS	LR and EC	Process	ECC	3	Nonoperative, operative, and rehabilitation guidelines for the treatment of glenohumeral osteoarthritis
AAOS CPG: Treatment of Osteoarthritis of the Knee (Non-Arthroplasty) (2013)	AAOS	LR and EC	Process	ECC	10	Nonoperative, operative, and rehabilitation guidelines for the treatment of knee osteoarthritis
AAOS CPG: Diagnosis and Treatment of Osteochondritis Dissecans (2010)	AAOS	LR and EC	Process	ECC	4	Nonoperative, operative, and rehabilitation guidelines for the treatment of osteochondritis dissecans
AAOS CPG: Optimizing the Management of Rotator Cuff Problems (2010)	AAOS	LR and EC	Process	ECC	6	Nonoperative, operative, and rehabilitation guidelines for the treatment of rotator cuff injury

AAOS, American Academy of Orthopaedic Surgeons; AAPM&R, American Academy of Physical Medicine and Rehabilitation; ACR, American College of Radiology; AHRQ, Agency for Healthcare Research and Quality; AMA, American Medical Association; AOSSM, American Orthopaedic Society for Sports Medicine; CCC, communication and care coordination; CPG, Clinical Practice Guidelines; EC, expert consensus; ECC, effective clinical care; LR, literature review; MRA, magnetic resonance arthrogram; MRI, magnetic resonance imaging; NASM, National Academy of Sports Medicine; NATA, National Athletic Trainers' Association; NCQA, National Committee for Quality Assurance; NQMC, National Quality Measures Clearinghouse; PCPI, Physician Consortium for Physician Improvement; PQRS, Physician Quality Reporting System; PS, patient safety.

were process-related. We found a lower percentage in our review, likely because of the inclusion of functional outcome metrics related to the lower extremity. Although process measures are important and are often used to ensure “best practices” and consistent care, they may not lead to improvement in patient outcomes, one of the main goals of providing quality health care.<sup>19,20</sup> Although an exclusive focus on outcome measures is not feasible, increasing use of outcome measures would facilitate processes that serve to improve the quality of care provided to the health care consumer. For example, focusing only on outcomes measures would identify a problem (i.e., poor outcomes following rotator cuff repair) but would not identify why a problem exists or a solution for the problem. A process measure would be required to address a poor outcome measure

(i.e., ensuring a patient has ceased smoking or has adequate glycemic control prior to elective rotator cuff repair).

These measures are gaining increasing importance as the health care model in the United States shifts from fee-for-service to payments made for the provision of quality care. One example of this are the PQRS measures, a CMS-defined list of quality measures that allows for payment adjustments to organizations who treat Medicare patients based on reporting.<sup>8</sup> In this investigation, we identified 47 sports medicine—specific quality measures, many relating to AAOS CPGs (Table 5). There were 19 quality measures relating to the general practice of orthopaedic surgery. These centered around the administration of perioperative antibiotics, deep venous thrombosis prophylaxis (when

**Table 5.** Individual Sports Medicine—Specific Quality Measures

Measure Number	Source	NQS Domain	Structure, Process, or Outcome	Measure	Endorsement/Steward
1	PQRS	CCC	Outcome	Functional status change for patients with elbow, wrist, or hand impairments	NQF 0427, PQRS 222, Focus on Therapeutic Outcomes
2	PQRS	CCC	Outcome	Functional status change for patients with hip impairments	NQF 0423, PQRS 218, Focus on Therapeutic Outcomes
3	PQRS	CCC	Outcome	Functional status change for patients with knee impairments	NQF 0422, PQRS 217, Focus on Therapeutic Outcomes
4	PQRS	CCC	Outcome	Functional status change for patients with shoulder impairments	NQF 0426, PQRS 221, Focus on Therapeutic Outcomes
5	PQRS	CCC	Outcome	Functional status change for patients with foot and ankle impairments	NQF 0424, PQRS 219, Focus on Therapeutic Outcomes
6	AHRQ NQMC	PS, ECC	Process	Diagnostic imaging: percentage of imaging studies for patients aged 18 years and older with knee pain who undergo knee MRI or MRA who are known to have had knee radiographs performed within the preceding 3 months based on information from the radiology information system (RIS), patient-provided radiologic history, or other health care source	ACR, NCQA, AMA PCPI
7	AHRQ NQMC	PS, ECC	Process	Diagnostic imaging: percentage of imaging studies for patients aged 18 years and older with shoulder pain undergoing shoulder MRI, MRA, or a shoulder ultrasonograph who are known to have had shoulder radiographs performed within the preceding 3 months based on information from the radiology information system (RIS), patient-provided radiologic history, or other health care source	ACR
8	AAOS CPG: Diagnosis and Treatment of Acute Achilles Tendon Rupture (2009)	ECC	Process	In the absence of reliable evidence, it is the opinion of this work group that a detailed history and physical examination be performed. The physical examination should include 2 or more of the following tests to establish the diagnosis of acute Achilles tendon rupture: (1) clinical Thompson test (Simmonds squeeze test), (2) decreased ankle plantar flexion strength, (3) presence or palpable gap (defect, loss of contour), and (4) increased passive ankle dorsiflexion with gentle manipulation (Consensus)	AAOS
9	AAOS CPG: Diagnosis and Treatment of Acute Achilles Tendon Rupture (2009)	ECC	Process	In the absence of reliable evidence, it is the opinion of the work group that although operative treatment is an option, it should be approached more cautiously in patients with diabetes, neuropathy, immunocompromised states, age above 65, tobacco use, sedentary lifestyle, obesity (BMI >30), peripheral vascular disease, or local/systemic dermatologic disorders. (Consensus)	AAOS
10	AAOS CPG: Diagnosis and Treatment of Acute Achilles Tendon Rupture (2009)	ECC	Process	We suggest early (i.e., 2 weeks) postoperative protected weight bearing for patients with acute Achilles tendon rupture who have been treated operatively. (Moderate)	AAOS

(continued)

Table 5. Continued

Measure Number	Source	NQS Domain	Structure, Process, or Outcome	Measure	Endorsement/Steward
11	AAOS CPG: Diagnosis and Treatment of Acute Achilles Tendon Rupture (2009)	ECC	Process	We suggest the use of a protective device that allows mobilization by 2-4 weeks postoperatively. (Moderate)	AAOS
12	AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	ECC	Process	Strong evidence supports that the practitioner obtain a relevant history and perform a musculoskeletal examination of the lower extremities, because these are effective diagnostic tools for ACL injury. (Strong)	AAOS, NASM, AOSSM, NATA, AAPM&R
13	AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	ECC	Process	In the absence of reliable evidence, it is the opinion of the work group that in the initial evaluation of a person with a knee injury and associated symptoms [giving way, pain, locking, catching] and signs [effusion, inability to bear weight, bone tenderness, loss of motion, and/or pathological laxity] that the practitioner obtain AP and lateral knee radiographs to identify fractures or dislocations requiring emergent care. (Consensus)	AAOS, NASM, AOSSM, NATA, AAPM&R
14	AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	ECC	Process	Strong evidence supports that the MRI can provide confirmation of ACL injury and assist in identifying concomitant knee pathology such as other ligament, meniscal, or articular cartilage injury. (Strong)	AAOS, NASM, AOSSM, NATA, AAPM&R
15	AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	ECC	Process	Moderate evidence supports surgical reconstruction in active young adult (18-35) patients with an ACL tear. (Moderate)	AAOS, NASM, AOSSM, NATA, AAPM&R
16	AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	ECC	Process	When ACL reconstruction is indicated, moderate evidence supports reconstruction within 5 months of injury to protect the articular cartilage and menisci. (Moderate)	AAOS, NASM, AOSSM, NATA, AAPM&R
17	AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	ECC	Process	In the absence of reliable evidence, it is the opinion of the work group that patients with an ACL tear and a locked knee secondary to a displaced meniscal tear have prompt treatment to unlock the knee to avoid a fixed flexion contracture. (Consensus)	AAOS, NASM, AOSSM, NATA, AAPM&R
18	AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	ECC	Process	Strong evidence supports that in patients undergoing intra-articular ACL reconstruction, the practitioner should use either a single- or double-bundle technique, because the measured outcomes are similar. (Strong)	AAOS, NASM, AOSSM, NATA, AAPM&R
19	AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	ECC	Process	Strong evidence supports that in patients undergoing intra-articular ACL reconstruction using autograft tissue, the practitioner should use bone-patellar tendon-bone or hamstring-tendon grafts, because the measured outcomes are similar. (Strong)	AAOS, NASM, AOSSM, NATA, AAPM&R

(continued)

**Table 5.** Continued

Measure Number	Source	NQS Domain	Structure, Process, or Outcome	Measure	Endorsement/Steward
20	AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	ECC	Process	Strong evidence supports that in patients undergoing ACL reconstructions, the practitioner should use either autograft or appropriately processed allograft tissue, because the measured outcomes are similar, although these results may not be generalizable to all allografts or all patients, such as young patients or highly active patients. (Strong)	AAOS, NASM, AOSSM, NATA, AAPM&R
21	AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	ECC	Process	Moderate evidence supports that in patients undergoing intra-articular ACL reconstruction, the practitioner could use either a tibial independent approach or a transtibial approach for the femoral tunnel, because the measured outcomes are similar. (Moderate)	AAOS, NASM, AOSSM, NATA, AAPM&R
22	AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	ECC	Process	Moderate evidence does not support the routine use of functional knee bracing after isolated ACL reconstruction, because there is no proven efficacy. (Moderate)	AAOS, NASM, AOSSM, NATA, AAPM&R
23	AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	ECC	Process	Moderate strength evidence from pooled analyses with a small effect size (number needed to treat = 109) supports that neuromuscular training programs could reduce ACL injuries. (Moderate)	AAOS, NASM, AOSSM, NATA, AAPM&R
24	AAOS CPG: Management of Anterior Cruciate Ligament Injuries (2014)	ECC	Process	For those undergoing postoperative rehabilitation after ACL reconstruction, moderate evidence supports early, accelerated, and nonaccelerated protocols because they have similar outcomes. (Moderate)	AAOS, NASM, AOSSM, NATA, AAPM&R
25	AAOS CPG: Treatment of Glenohumeral Joint Osteoarthritis (2009)	ECC	Process	We suggest total shoulder arthroplasty over hemiarthroplasty when treating patients with glenohumeral joint osteoarthritis. (Moderate)	AAOS
26	AAOS CPG: Treatment of Glenohumeral Joint Osteoarthritis (2009)	ECC	Process	In the absence of reliable evidence, it is the opinion of this work group that physicians use perioperative mechanical and/or chemical VTE (venous thromboembolism) prophylaxis for shoulder arthroplasty patients. (Consensus)	AAOS
27	AAOS CPG: Treatment of Glenohumeral Joint Osteoarthritis (2009)	ECC	Process	In the absence of reliable evidence, it is the opinion of this work group that total shoulder arthroplasty not be performed in patients with glenohumeral osteoarthritis who have an irreparable rotator cuff tear. (Consensus)	AAOS
28	AAOS CPG: Treatment of Osteoarthritis of the Knee (Non-Arthroplasty) (2013)	ECC	Process	We recommend that patients with symptomatic osteoarthritis of the knee participate in self-management programs, strengthening, low-impact aerobic exercises, and neuromuscular education; and engage in physical activity consistent with national guidelines. (Strong)	AAOS
29	AAOS CPG: Treatment of Osteoarthritis of the Knee (Non-Arthroplasty) (2013)	ECC	Process	We suggest weight loss for patients with symptomatic osteoarthritis of the knee and a BMI equal to 25. (Moderate)	AAOS

(continued)

Table 5. Continued

Measure Number	Source	NQS Domain	Structure, Process, or Outcome	Measure	Endorsement/Steward
30	AAOS CPG: Treatment of Osteoarthritis of the Knee (Non-Arthroplasty) (2013)	ECC	Process	We cannot recommend using acupuncture in patients with symptomatic osteoarthritis of the knee. (Strong)	AAOS
31	AAOS CPG: Treatment of Osteoarthritis of the Knee (Non-Arthroplasty) (2013)	ECC	Process	We cannot suggest that lateral wedge insoles be used for patients with symptomatic medial compartment osteoarthritis of the knee. (Moderate)	AAOS
32	AAOS CPG: Treatment of Osteoarthritis of the Knee (Non-Arthroplasty) (2013)	ECC	Process	We cannot recommend using glucosamine and chondroitin for patients with symptomatic osteoarthritis of the knee. (Strong)	AAOS
33	AAOS CPG: Treatment of Osteoarthritis of the Knee (Non-Arthroplasty) (2013)	ECC	Process	We recommend nonsteroidal anti-inflammatory drugs (NSAIDs; oral or topical) or Tramadol for patients with symptomatic osteoarthritis of the knee. (Strong)	AAOS
34	AAOS CPG: Treatment of Osteoarthritis of the Knee (Non-Arthroplasty) (2013)	ECC	Process	We cannot recommend using hyaluronic acid for patients with symptomatic osteoarthritis of the knee. (Strong)	AAOS
35	AAOS CPG: Treatment of Osteoarthritis of the Knee (Non-Arthroplasty) (2013)	ECC	Process	We cannot suggest that the practitioner use needle lavage for patients with symptomatic osteoarthritis of the knee. (Moderate)	AAOS
36	AAOS CPG: Treatment of Osteoarthritis of the Knee (Non-Arthroplasty) (2013)	ECC	Process	We cannot recommend performing arthroscopy with lavage and/or debridement in patients with a primary diagnosis of symptomatic osteoarthritis of the knee. (Strong)	AAOS
37	AAOS CPG: Treatment of Osteoarthritis of the Knee (Non-Arthroplasty) (2013)	ECC	Process	In the absence of reliable evidence, it is the opinion of the work group not to use the free-floating (un-fixed) interpositional device in patients with symptomatic medial compartment osteoarthritis of the knee. (Consensus)	AAOS
38	AAOS CPG: Diagnosis and Treatment of Osteochondritis Dissecans (2010)	ECC	Process	In the absence of reliable evidence, it is the opinion of the work group that symptomatic skeletally immature patients with salvageable unstable or displaced OCD lesions be offered the option of surgery. (Consensus)	AAOS
39	AAOS CPG: Diagnosis and Treatment of Osteochondritis Dissecans (2010)	ECC	Process	In the absence of reliable evidence, it is the opinion of the work group that symptomatic skeletally mature patients with salvageable unstable or displaced OCD lesions be offered the option of surgery. (Consensus)	AAOS
40	AAOS CPG: Diagnosis and Treatment of Osteochondritis Dissecans (2010)	ECC	Process	In the absence of reliable evidence, it is the opinion of the work group that patients who remain symptomatic after treatment for OCD have a history and physical examination, radiographs, and/or MRI to assess healing. (Consensus)	AAOS

(continued)

**Table 5.** Continued

Measure Number	Source	NQS Domain	Structure, Process, or Outcome	Measure	Endorsement/Steward
41	AAOS CPG: Diagnosis and Treatment of Osteochondritis Dissecans (2010)	ECC	Process	In the absence of reliable evidence, it is the opinion of the work group that patients who have received surgical treatment of OCD be offered postoperative physical therapy. (Consensus)	AAOS
42	AAOS CPG: Optimizing the Management of Rotator Cuff Problems (2010)	ECC	Process	In the absence of reliable evidence, it is the opinion of the work group that surgery not be performed for asymptomatic, full-thickness rotator cuff tears. (Consensus)	AAOS
43	AAOS CPG: Optimizing the Management of Rotator Cuff Problems (2010)	ECC	Process	We suggest that patients who have rotator cuff–related symptoms in the absence of a full-thickness tear be initially treated nonoperatively using exercise and/or nonsteroidal anti-inflammatory drugs. (Moderate)	AAOS
44	AAOS CPG: Optimizing the Management of Rotator Cuff Problems (2010)	ECC	Process	It is an option for physicians to advise patients that the following factor correlates with less favorable outcomes after rotator cuff surgery: Worker’s Compensation Status. (Moderate)	AAOS
45	AAOS CPG: Optimizing the Management of Rotator Cuff Problems (2010)	ECC	Process	We suggest that routine acromioplasty is not required at the time of rotator cuff repair. (Moderate)	AAOS
46	AAOS CPG: Optimizing the Management of Rotator Cuff Problems (2010)	ECC	Process	We suggest surgeons not use a non-crosslinked, porcine small intestine submucosal xenograft patch to treat patients with rotator cuff tears. (Moderate)	AAOS
47	AAOS CPG: Optimizing the Management of Rotator Cuff Problems (2010)	ECC	Process	In the absence of reliable evidence, it is the opinion of the work group that local cold therapy is beneficial to relieve pain after rotator cuff surgery. (Consensus)	AAOS

AAOS, American Academy of Orthopaedic Surgeons; AAPM&R, American Academy of Physical Medicine and Rehabilitation; ACR, American College of Radiology; AHRQ, Agency for Healthcare Research and Quality; AMA, American Medical Association; AOSSM, American Orthopaedic Society for Sports Medicine; BMI, body mass index; CCC, communication and care coordination; CPG, Clinical Practice Guidelines; ECC, effective clinical care; NASM, National Academy of Sports Medicine; NATA, National Athletic Trainers’ Association; NCQA, National Committee for Quality Assurance; NQF, National Quality Forum; NQMC, National Quality Measures Clearinghouse; PCPI, Physician Consortium for Physician Improvement; PQRS, Physician Quality Reporting System; PS, patient safety; QPS, Quality Positioning System.

**Table 6.** Summary of General Orthopaedic Surgery Quality Measure Developers and Domains

Source	Developer	Development Methodology	Structure, Process, or Outcome	NQS Domains	No. of Measures	Topics
NQF QPS	CHOP	Unknown	Outcome	PS	2	Percentage of patients with death after admission or during inpatient stay
AHRQ NQMC	AAOS, AMA PCPI, ICSI, CMS, The Joint Commission	LR and EC	Process (2) Outcome (1)	ECC (2) PS (1)	3	<ul style="list-style-type: none"> <li>• Unplanned readmission</li> <li>• Percentage of patients with a fragility fracture receiving supplementary calcium and vitamin D</li> <li>• Percentage of patients with a diagnosis of osteoarthritis who have had assessment for function and pain.</li> </ul>
PQRS	AMA PCPI, NCQA, AAOS, CMS, QIP, ACS	Unknown	Process (11) Outcome (3)	PS (5) CCC (3) PCCEO (3) ECC (3)	14	<ul style="list-style-type: none"> <li>• Administration of prophylactic antibiotics</li> <li>• Discontinuation of prophylactic antibiotics within 24 hours</li> <li>• Deep venous thrombosis prophylaxis</li> <li>• Post-hospital discharge follow-up</li> <li>• Pain and function assessments in patients with osteoarthritis</li> <li>• Medicine reconciliation</li> <li>• Pain assessment</li> <li>• Functional outcome assessment</li> <li>• Health care access, provider-patient communication</li> <li>• Unplanned reoperation or readmission</li> <li>• Surgical site infection</li> <li>• Postoperative complication risk assessment (nonemergent surgery)</li> <li>• Documentation of visit back to referring provider</li> </ul>

AAOS, American Academy of Orthopaedic Surgeons; ACS, American College of Surgeons; AHRQ, Agency for Healthcare Research and Quality; AMA, American Medical Association; CCC, communication and care coordination; CHOP, Children's Hospital of Philadelphia; CMS, Centers for Medicare and Medicaid Services; EC, expert consensus; ECC, effective clinical care; ICSI, Institute for Clinical Systems Improvement; LR, literature review; NCQA, National Committee for Quality Assurance; NQF, National Quality Forum; NQMC, National Quality Measures Clearinghouse; PCCEO, person and caregiver-centered experience and outcomes; PCPI, Physician Consortium for Physician Improvement; PQRS, Physician Quality Reporting System; PS, patient safety; QIP, Quality Insights of Pennsylvania; QPS, Quality Positioning System.

**Table 7.** Individual General Orthopaedic Surgery Quality Measures Applicable to a Practicing Sports Medicine Surgeon

Measure Number	Source	NQS Domain	Structure, Process, or Outcome	Measure	Endorsement/Steward
1	NQF QPS	PS	Outcome	Percentage of patients who died with documented or undocumented complications within 30 days from admission.	NQF 0353, CHOP
2	NQF QPS	PS	Outcome	Percentage of patients who died with documented or undocumented complications in the hospital	NQF 0352, CHOP
3	AHRQ NQMC	ECC	Process	Osteoarthritis: percentage of patient visits for patients aged 21 and older with a diagnosis of osteoarthritis with assessment for function and pain	AAOS, AMA PCPI
4	AHRQ NQMC	ECC	Process	Diagnosis and treatment of osteoporosis: percentage of patients with a low-impact (fragility) fracture who are taking calcium and vitamin D dietary supplementation	ICSI
5	AHRQ NQMC	PS	Outcome	Unplanned readmission: hospital-wide all-cause, unplanned readmission rate (HWR)	CMS, The Joint Commission
6	PQRS	PS	Process	Percentage of surgical patients aged 18 years and older undergoing procedures with the indications for a first OR second generation cephalosporin prophylactic antibiotic, who had an order for a first OR second generation cephalosporin for antimicrobial prophylaxis	NQF 0268, PQRS 021, AMA PCPI, NCQA
7	PQRS	PS	Process	Percentage of noncardiac surgical patients aged 18 years and older undergoing procedures with the indications for prophylactic parenteral antibiotics AND who received a prophylactic parenteral antibiotic, who have an order for discontinuation of prophylactic parenteral antibiotics within 24 hours of surgical end time	NQF 0271, PQRS 022, AMA PCPI, NCQA
8	PQRS	PS	Process	Percentage of surgical patients aged 18 years and older undergoing procedures for which VTE prophylaxis is indicated in all patients, who had an order for low-molecular-weight heparin (LMWH), low-dose unfractionated heparin (LDUH), adjusted-dose warfarin, fondaparinux or mechanical prophylaxis to be given within 24 hours prior to incision time or within 24 hours after surgery end time	NQF 0239, PQRS 023, AMA PCPI, NCQA
9	PQRS	CCC	Process	The percentage of discharges from any inpatient facility (e.g., hospital, skilled nursing facility, or rehabilitation facility) for patients 18 years and older of age seen within 30 days following discharge in the office by the physician, prescribing practitioner, registered nurse, or clinical pharmacist providing ongoing care for whom the discharge medication list was reconciled with the current medication list in the outpatient medical record. This measure is reported as 3 rates stratified by age group: <ul style="list-style-type: none"> <li>• Reporting criteria 1: 18-64 years of age</li> <li>• Reporting criteria 2: 65 years and older</li> <li>• Total rate: All patients 18 years of age and older</li> </ul>	NQF 0097, PQRS 046, AMA PCPI, NCQA
10	PQRS	PCCEO	Process	Percentage of patient visits for patients aged 21 years and older with a diagnosis of osteoarthritis (OA) with assessment for function and pain	PQRS 109, AAOS
11	PQRS	PS	Process	Percentage of visits for patients aged 18 years and older for which the eligible professional attests to documenting a list of current medications using all immediate resources available on the date of the encounter. This list must include ALL known prescriptions, over-the-counters, herbals, and vitamin/mineral/dietary (nutritional) supplements AND must contain the medications' name, dosage, frequency, and route of administration.	NQF 0419, PQRS 130, CMS, QIP
12	PQRS	CCC	Process	Percentage of visits for patients aged 18 years and older with documentation of a pain assessment using a standardized tool(s) on each visit AND documentation of a follow-up plan when pain is present	NQF 0420, PQRS 131, CMS, QIP

(continued)

Table 7. Continued

Measure Number	Source	NQS Domain	Structure, Process, or Outcome	Measure	Endorsement/Steward
13	PQRS	CCC	Process	Percentage of visits for patients aged 18 years and older with documentation of a current functional outcome assessment using a standardized functional outcome assessment tool on the date of encounter AND documentation of a care plan based on identified functional outcome deficiencies on the date of the identified deficiencies.	NQF 2624, PQRS 182, CMS, QIP
14	PQRS	PCCEO	Process	<ul style="list-style-type: none"> <li>• Getting timely care, appointments, and information</li> <li>• How well providers communicate</li> <li>• Patient's rating of provider</li> <li>• Access to specialists</li> <li>• Health promotion and education</li> <li>• Shared decision making</li> <li>• Health status/functional status</li> <li>• Courteous and helpful office staff</li> <li>• Care coordination</li> <li>• Between-visit communication</li> <li>• Helping the patient to take medication as directed</li> <li>• Stewardship of patient resources</li> </ul>	NQF 0005, PQRS 321, AHRQ
15	PQRS	PS	Outcome	Percentage of patients aged 18 years and older who had any unplanned reoperation within the 30-day postoperative period	PQRS 355, ACS
16	PQRS	ECC	Outcome	Percentage of patients aged 18 years and older who had an unplanned hospital readmission within 30 days of principal procedure	PQRS 356, ACS
17	PQRS	ECC	Outcome	Percentage of patients aged 18 years and older who had a surgical site infection (SSI)	PQRS 357, ACS
18	PQRS	PCCEO	Process	Percentage of patients who underwent a nonemergency surgery who had their personalized risks of postoperative complications assessed by their surgical team prior to surgery using a clinical data-based, patient-specific risk calculator and who received personal discussion of those risks with the surgeon	PQRS 358, ACS
19	PQRS	ECC	Process	Percentage of patients with referrals, regardless of age, for which the referring provider receives a report from the provider to whom the patient was referred	PQRS 374, CMS

AAOS, American Academy of Orthopaedic Surgeons; ACS, American College of Surgeons; AHRQ, Agency for Healthcare Research and Quality; AMA, American Medical Association; CCC, communication and care coordination; CHOP, Children's Hospital of Philadelphia; CMS, Centers for Medicare and Medicaid Services; ECC, effective clinical care; ICSI, Institute for Clinical Systems Improvement; NCQA, National Committee for Quality Assurance; NQF, national quality forum; NQMC, National Quality Measures Clearinghouse; PCCEO, person and caregiver-centered experience and outcomes; PCPI, physician consortium for physician improvement; PQRS, physician quality reporting system; PS, patient safety; QIP, quality insights of Pennsylvania; QPS, quality positioning system.

indicated), postoperative follow-up, surgical complications and reoperations, unplanned admissions, as well as a variety of other measures (Table 7).

Many of these PQRS measures are applied to payment programs, public reporting, quality improvement (internal to the specific organization), quality improvement with benchmarking (external benchmarking to multiple organizations), and regulatory and accreditation program. The 5 sports medicine-specific PQRS measures are highly relevant to practicing orthopaedic sports medicine physicians as they measure changes in functional status during treatment for common joint pathologies. Although some of the other 14 PQRS measures identified may not be as relevant within a sports medicine practice at this time, adjustment in regulatory policy may change this fact. Should some of the measures identified in this review become adjusted for patient comorbidities or be compared with other practicing orthopaedic sports medicine physicians, they would become more relevant.

One notable absence from the search results are quality measures relating to concussion. This is likely due to the fact that concussions and their long-term effects have only recently been recognized, and the diagnosis and management of those with suspected concussion is still undergoing standardization. Furthermore, although standardized assessment tools are available to diagnose concussions (e.g., Sport Concussion Assessment Tool),<sup>21</sup> they are reliant on subjective symptoms of the athlete as well as physical examination findings. Completely objective, evidence-based measures to diagnose concussion and determine return to play, such as eye-tracking and vestibular testing, are still under investigation.<sup>22,23</sup>

Organizations are using quality measure data to institute improvements in patient care as well as a basis for reimbursement.<sup>19,20</sup> It is important for orthopaedic sports medicine specialists to be knowledgeable about these measures. This will ensure surgeons are judged appropriately, allow physicians to be involved in the development of future quality measures, and effectively represent both the patient and physician interests in the development of health care policy. The ultimate goal of quality measures is to provide improved care to patients through high-value, cost-effective practices. This is done by using quality measures to assess care quality, identify suboptimal performance, and implement initiatives to improve patient care. A well-developed measure can provide comparative data on a variety of health care treatments to inform providers and payers about the benefits and shortcomings of these options and interventions. Physicians should have a direct role in the creation of well-formulated quality measures as they often perform the research leading to the development of the measure and have a central role in the provision

of health care to the patient. Orthopaedic sports medicine physicians who partake in this process can ensure that quality measures are created that will appropriately judge their practices and lead to improved and cost-effective patient care for sports medicine-related conditions.

### Limitations

The limitations of this investigation include the possibility of recording bias, given that further studies or quality measures might have been identified searching other databases. This is further highlighted as we only searched English-language databases. From a quality measure perspective, however, the databases searched in the current study represent the most comprehensive repository of quality measures. Additionally, there may have been bias among the creators of the quality measures themselves, with a focus on particular areas of interest (i.e., criteria for radiographs or magnetic resonance imaging) to the exclusion of others (i.e., concussions). Lastly, included topics in the search term were subjectively chosen by the authors; however, we attempted to cover all anatomic areas and conditions that a sports medicine physician would treat as part of their normal practice.

### Conclusions

There are many existing quality measures relating to the practice of orthopedic sports medicine. Most quality measures are process measures described within PQRS or AAOS CPGs.

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