

## Utilization of American Academy of Orthopedic Surgeons (AAOS) Appropriate Use Criteria for Non-Arthroplasty Treatment of Knee Osteoarthritis in Clinical Practice, Does it Imitate Reality?

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**Conflict-of-interest statement:** The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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Received: June 14, 2022

Revised: August 4, 2022

Accepted: August 8 2022

Published online: August 28, 2022

### ABSTRACT

**OBJECTIVE:** This study aimed to assess the use of Appropriate Use Criteria (AUC) by comparing the non-arthroplasty treatment of knee OA in our hospital with the AUC recommendations.

**METHODS:** The AUC for Non-Arthroplasty treatment of Knee Osteoarthritis (OA) was developed to help physicians in making evidence-based treatment for knee OA. A Retrospective review of the medical charts and radiographs of all adult patients with knee OA from August to November 2018 was conducted. We collected data for age, gender, pain level, mechanical symptoms, ROM, ligamentous instability, radiographic pattern and severity, limb alignment, and the treatments. The data entered in the AUC application to assess its use

and the rate of the treatment's appropriateness. We then compared the actual treatment provided with AUC recommendations to assess the agreement between both.

**RESULTS:** 150 patients with a mean age of 55.7 years (34-86years) and 67% female were treated at the knee clinic. 61(11%) scenarios were observed. The most common scenario (17.3%) was a middle-aged female with function-limiting pain at moderate to long-distance without mechanical symptoms, normal limb alignment, full range of motion, no ligamentous instability with mild to moderate joint space loss involving one compartment. The overall rate of the appropriate treatment and in agreement with the AUC recommendations was 95.7%, may be appropriate in 4.2% and rarely appropriate in 0.1%. The appropriate treatment was in agreement with the AUC recommendations for self-management, physical therapy, and NSAIDs in 100%, acetaminophen in 92.5%, and Intra-articular steroid in 45.5%.

**CONCLUSIONS:** This study showed that the non-arthroplasty treatments of knee OA were appropriate in most cases. However, the agreement with AUC recommendations was observed in a few treatment options at our center. The use of AUC application was easy for identifying the evidence-based treatment options for knee OA. We recommend a prospective study to assess the outcome of AUC application.

**Key words:** Appropriate Use Criteria; American Academy of Orthopedic Surgeons; Knee; Osteoarthritis; Non-arthroplasty; Surgical

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Abulhail S, Samhadaneh MA, Darwiche A, Aldahamsheh O, Alhaneedi GA. Utilization of American Academy of Orthopedic Surgeons (AAOS) Appropriate Use Criteria for Non-Arthroplasty Treatment of Knee Osteoarthritis in Clinical Practice, Does it Imitate Reality? *International Journal of Orthopaedics* 2022; 9(4): 1676-1680 Available from: URL: <http://www.ghrnet.org/index.php/ijo/article/view/3311>

## INTRODUCTION

Knee osteoarthritis (OA) is the most common type of Osteoarthritis and results from an imbalance between the breakdown and repair of articular cartilage with an estimated annual incidence of 240 persons per 100000 population<sup>[1-3]</sup>. The disease significantly affects patient quality of life and productivity, resulting in economic costs that are aggravated by the use of pharmacological therapy and total health care resources<sup>[4]</sup>. The Centers of Disease Control reported that one in two individuals may develop symptoms of osteoarthritis in at least one knee by the age of 85 years<sup>[2,5]</sup>.

The majority of knee osteoarthritis conditions are treated non-surgically, however, surgical treatment sometimes is recommended for a certain case of osteoarthritis with severe symptoms not responding to non-surgical treatments<sup>[6-8]</sup>.

The American Academy of Orthopedic Surgeons (AAOS) published clinical practice guidelines for treatment of knee OA in 2013 based on the best available evidence<sup>[5]</sup>. Later, the American Academy of Orthopedic Surgeons (AAOS) has published the Appropriate Use Criteria (AUC) for non-arthroplasty treatment

for osteoarthritis of the knee based on the Evidence-based information, in conjunction with the clinical expertise of physicians from multiple medical specialties to improve patient care and outcomes<sup>[9,10]</sup>.

The AUC for non-arthroplasty treatment of Knee OA was developed to help physicians in making evidence based treatment for knee OA. It involves assessment of eight factors for each patient including (1) Function-Limiting Pain, (2) Range of Motion in Extension and Flexion, (3) ligamentous Instability, (4) Pattern of arthritis involvement, (5) Severity of Knee OA on radiographs, (6) Limb Alignment, (7) Mechanical Symptoms, (8) Age. After that, an appropriateness rating is generated for each of the ten treatment options as appropriate from 7 to 9, may be appropriate from 4 to 6, and rarely appropriate from 1 to 3<sup>[6,11]</sup>.

Appropriate healthcare service is one for which the expected health benefits exceed the expected negative consequences by a sufficiently wide margin<sup>[9,10]</sup>.

This study aimed to assess the utilization of AAOS AUC for Non-arthroplasty treatment of Knee Osteoarthritis by comparing the non-arthroplasty treatment of knee OA provided in our institution with the AUC recommendations to measure the rate of appropriateness and the agreement with the AUC recommendations.

**Table 1** Patients' characteristics.

Patients		Frequency	Percentage
Age	Elderly	26	17.3
	Middle	100	66.7
	Young	24	16
Gender	Female	101	67.3
	Male	49	32.7
Function limiting pain	At rest and night	19	12.7
	Moderate to long-distance	80	53.3
	Short distance	51	34
Range of Motion	Full range	114	76
	Lack of full extension and flexion	36	24
Ligamentous instability	No	143	95.3
	Yes	7	4.7
Involved compartment	More than one compartment	73	48.7
	Predominantly one compartment	77	51.3
Joint space	Mild to moderate loss	105	70
	Severe loss	45	30
Limb Alignment	Mal-alignment	39	26
	Normal	111	74
Mechanical Symptoms	Absent	141	94
	Present	9	6

## MATERIALS AND METHODS

The study granted exemption from requiring approval from the Institutional Review Board (IRB), and the approval was obtained from the hospital research committee.

The inclusion criteria were adult patients > 18 years with primary knee osteoarthritis treated with non-arthroplasty treatment between August 2018 and November 2018 at our knee clinic.

Patients with other causes of osteoarthritis (inflammatory, traumatic), previous surgical intervention, neoplasm, neuropathy, vascular disease, ankle and foot deformity, ipsilateral hip and knee arthritis, incomplete documentation, and the patient who planned to do knee arthroplasty were excluded.

The medical charts and radiographs of the patients were retrospectively reviewed. The data collected for age, gender, pain level, mechanical symptoms, range of motion and ligamentous instability, radiographic pattern, and severity using Kellgren-Lawrence grading system (KL), limb alignment, and the non-arthroplasty treatment options (Table 1 and 2).

The AUC application requires eight patient parameters to generate appropriateness ratings for non-arthroplasty treatments of knee osteoarthritis.

**Table 2** The AUC treatment options, rate of appropriateness, and agreement.

Actual Treatment	Number of patients	Appropriate	May be Appropriate	Rarely Appropriate	Agreement with AUC recommendation	
					Yes	No
Self- management program	150	150 (100%)	-	-	100%	-
Prescribed physical therapy	125	125 (83.3%)	-	-	100%	-
NSAID	87	87 (58%)	-	-	100%	-
Acetaminophen	75	68 (45.3%)	7 (4.7 %)	-	92.50%	7.50%
Tramadol	1	-	1 (0.7%)	-	-	100%
Narcotic	1	-	-	1 (0.7%)	-	100%
Intra-articular steroid	11	5 (3.3%)	6 (4.0%)	-	45.50%	54.50%
Hinged Knee Brace /unloading brace	5	-	5 (3.3%)	-	-	100%
Arthroscopic partial meniscectomy or loose body removal	-	-	-	-	-	-
Realignment osteotomy	-	-	-	-	-	-
<b>Total Treatments</b>	<b>464</b>	<b>444 (95.7%)</b>	<b>19 (4.1%)</b>	<b>1 (0.2%)</b>	<b>95.70%</b>	<b>4.30%</b>

**Table 3** Patient’s Scenarios.

AUC Scenarios								
Age	Function limiting pain	Range of motion	Pattern of arthritic involvement	Imaging joint space	Limb Alignment	Ligamentous instability	Mechanical symptoms	Number of patients
Middle	Moderate to long	Full range	Predominantly one compartment	Mild to moderate loss	normal	No	Absent	26(17.3%)
Young	Moderate to long	Full range	Predominantly one compartment	Mild to moderate loss	normal	No	Absent	19(12.7%)
Middle	Moderate to long	Full range	More than one compartment	Mild to moderate loss	normal	No	Absent	9 (6%)
Middle	Short Distance	Full range	Predominantly one compartment	Mild to moderate loss	normal	No	Absent	7 (4.7%)
Middle	Short Distance	Lack of full extension and flexion	More than one compartment	Severe loss	normal	No	Absent	5 (3.3%)
Middle	Short Distance	Full range	More than one compartment	Mild to moderate loss	normal	No	Absent	4 (2.7%)
One patient observed in each of other 39 different scenarios								39 (26%)
Two patients observed in each of other 7 different scenarios								14 (9.3%)
Three patients observed in each of other 9 different scenarios								27 (18%)
Total	61 scenarios							150

The eight parameters were retrieved for 150 consecutive patients and entered in the AUC application to assess its utilization and measure the rate of the appropriateness of the non-arthroplasty treatments. The agreement between the actual treatment provided in our hospital with AUC recommendations was assessed.

**Statistical analysis**

Means and SDs for continuous and frequencies for categorical variables were used to describe the sample characteristics, patient scenarios, and treatment options. We reported the overall appropriateness of treatments as a percentage. After that, an appropriateness rating is generated as a percentage for each of the treatment options. For appropriate treatment, we reported the agreement of actual treatment provided with the AUC recommendation as percentage.

Data analysis was performed using the statistical software (IBM SPSS version 22; SPSS Inc., Chicago, IL).

**RESULTS**

One hundred fifty patients with knee osteoarthritis were eligible for inclusion criteria. Most of the patients aged between 34-86 years, with a mean age of 55.7 years. 67.3% of patients identified as female, and 66.7% were from the middle age group. Table 1 summarizes the patient’s characteristics.

61 (11%) scenarios out of 576 scenarios addressed by AUC were observed in our patients. The most common scenario (17.3%) was female middle age with function limiting pain at moderate to long-distance without mechanical symptoms, normal limb alignment, full range of motion, no ligamentous instability with mild to moderate joint space loss involving one compartment. Table 3 summarizes the patient’s scenarios.

Eight treatment options were used for our patients; self-management program (N=150), physical therapy (N=125), NSAID (N=87), Acetaminophen (N=75), Intra-articular corticosteroid (N=11), Brace (N=5), Narcotic (N=1) Tramadol (N=1) (Table 2).

The combined therapies prescribed for 96% of the patients. In contrast, 4% received only single therapy (self-management), and the most common combined therapy was three treatments (self-management, physical therapy, and NSAIDs) in 34.7% of patients (Table 4).

After utilizing the AUC and analyzing the appropriateness rate for each scenario, the overall rate of appropriate treatment was 95.7%, may be appropriate in 4.2% and rarely appropriate in 0.1% (Table 2).

The combined therapy was appropriate in 84%, may be appropriate in 11.3%, and rarely appropriate in 0.7% of patients (Table 4).

**Table 4** Combined therapy and appropriateness.

Treatments	Number	Appropriate	Maybe Appropriate	Rarely Appropriate
Single treatment	6 (4.0 %)	6 (4.0%)	--	--
Two treatments	42 (28.0%)	42 (28 %)	--	--
Three treatments	52 (34.7 %)	50 (33.3%)	2 (1.4 %)	--
Four treatments	38 (25.3 %)	30 (20 %)	7 (4.6%)	1 (0.7 %)
Five treatments	12 (8.0 %)	4 (2.7%)	8 (5.3 %)	--
Total	150	132 (88.0%)	17 (11.3 %)	1 (0.7%)

The overall agreement between the actual treatment provided at our center and the AUC recommendation was 95.7% of appropriate treatment options. In contrast, we found no agreement for the maybe and 4.3% for rarely appropriate treatments (Table 2).

When analyzing each treatment and based on the AUC, the agreement with the AUC recommendations was 100% for Self-management, physical therapy, and NSAIDs. In contrast, the agreement for acetaminophen and Intra articular steroid was (92.5%) and (45.5%) respectively. The remaining options of AUC recommendations were either rarely provided like tramadol, narcotic, and brace or not provided like the non-arthroplasty surgical options (Table 2).

**DISCUSSION**

The most important finding of this study was that the application of the AUC made selecting an appropriate non-arthroplasty treatment for each patient relatively simple and applicable.

Analysis of our cases using the AUC application showed that only a few of the AUC scenarios in our patients. This might be because of cultural differences that vary across different countries outside the USA.

The non-arthroplasty treatment for knee OA at our center was found to be appropriate in most cases with a predominance of self-management program and physical therapy. However, the agreement with AUC recommendations was observed in a few treatment options for majority of patients.

It is interesting to recognize that the non-pharmacological treatment options such as (self-management programs and physical therapy), acetaminophen and Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) were the most frequently utilized appropriate treatments and in agreement with the AUC recommendations at our center. This finding showed the consensus regarding such treatment modalities for knee OA at our institute with evidence-based indications.

Heuts *et al*<sup>[12]</sup> in a randomised clinical trial reported that the self-management program was positively influenced knee pain and self-reported functional level in the patients with knee OA.

Jamtvedt *et al*<sup>[13]</sup> in an overview of systematic reviews concluded that physical therapy, exercise and weight loss reduce pain and improve physical function in patients with knee OA.

The acetaminophen was recommended by the American College of Rheumatology guidelines as a preferred drug for knee OA<sup>[14]</sup>. Towheed *et al*<sup>[15]</sup> in a cochrane systematic review reported that the acetaminophen is more effective than placebo in treatment of Knee OA.

Bjoridal *et al*<sup>[16]</sup> in a meta-analysis of randomized controlled trials reported that the NSAIDs can reduce short term pain in osteoarthritis of the knee slightly better than placebo, but the current analysis does not support long term use of NSAIDs due to the serious adverse effects.

It is concerning that; using opioids like tramadol, intra-articular steroid injection, and braces were rarely or not commonly used for our patients with a low rate of appropriateness. The reasons might be due to the restriction and the need for unique prescription forms for tramadol and narcotics at our center, or the preference of patients or physicians.

The American College of Rheumatology guidelines support the use of opioids therapy when other treatments are ineffective or inappropriate<sup>[14]</sup>.

Bellamy *et al*<sup>[17]</sup> in a systematic review of 28 trials found a significant short-term reduction in pain and improvement in patient self-assessment with intra-articular corticosteroid injection compared with placebo injection. The non-arthroplasty operative options of the AUC were not used during patient's enrollment. It might be attributed to the lack of sound evidence for such operative modalities for knee OA.

Two well designed RCTs by Moseley *et al.* and Kirkley *et al.* showed no benefit of arthroscopic surgery for treatment of knee osteoarthritis<sup>[18,19]</sup>.

The use of evidence-based clinical tools, such as the AUC, in this subgroup of patients provided an opportunity to improve the quality of patient care by guiding the treating physicians in selecting an appropriate treatment option. Hence, the variation in the selected treatment for patients with knee OA could be decreased, and improve the patient care.

Morrison *et al*<sup>[20]</sup> evaluated the AUC for the Non-Arthroplasty treatment of knee osteoarthritis in veterans in a retrospective study and concluded that the non-arthroplasty care should be individualized to patients' needs, and the decision to arthroplasty should be considered only after exhausting appropriate conservative measures. Some drawbacks of AAOS AUC for non-arthroplasty treatment of knee OA were recognised. The appropriateness of combined therapy in the individual scenario was not defined in the AUC. When analysing the number of provided treatments in our patients, the combined therapies were prescribed in most cases and the literature reported acceptable options for combined therapy that will be helpful for patient outcomes.

Yazdanpanah *et al*<sup>[21]</sup> in a randomized controlled trial reported that the combined therapy increases the efficacy and reduce the severity of the side effects of the drugs.

Another shortcoming is that AUC criteria did not consider if the knee OA is unilateral or bilateral, and this might affect the type of appropriate treatment<sup>[22]</sup>. Furthermore, the AUC did not discuss the patient's weight or Body Mass Index (BMI) in the patient's characteristics, although the weight reduction is part of the AUC self-management program<sup>[5,9,12]</sup>.

There are several limitations of this study; retrospective design

of study, restriction of opioid prescriptions at our center, cultural differences and patient preference might affect the rate of the appropriateness of treatments. Individual radiographs may be suboptimal and can lead to the variability in the interpretation of severity of knee OA and the lack of patient outcomes to validate the AUC application in clinical practice was another limitation of this study.

**In conclusion**, the non-arthroplasty treatments of knee OA were appropriate in most cases. but the agreement with AUC recommendations observed in a few treatment options at our center. The AUC application was easy for identifying the different treatment options for knee OA. We recommend a prospective study to assess the outcome of AUC application in practice.

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