

The Cost-Effectiveness of Inpatient and Outpatient Physical Therapy Programs in Knee Osteoarthritis

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ABSTRACT

Background: Physical therapy and exercise are frequently used therapies for knee osteoarthritis (KOA) patients. This study aims to evaluate inpatient and outpatient physical therapy programs' cost-effectiveness in KOA patients.

Methods: This randomized trial consists of sixty KOA patients who were randomly divided into two groups. The same combined physical therapy program was given to Group 1 (n=30) in the inpatient setting, and Group 2 (n=30) in the outpatient setting. Pain intensity was evaluated by Visual Analog Scale (VAS), functional activity with Stair Climb, Chair Stand Tests, and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), fall risk with Hendrich II Fall Risk Scale, and quality of life with ShortForm-36 (SF-36). Direct and indirect costs were calculated five times during the entire study.

Results: After the six-month follow-up period, Group 1 showed a significant improvement in all parameters ($p < 0.05$). Group 2 improved in all parameters ($p < 0.05$), except for Chair Stand Test, WOMAC stiffness subscale, and SF-36 physical and emotional role functioning ($p > 0.05$). The total inpatient treatment cost (€1182.36) was higher than the outpatient group (€547.07). The utility was higher in the outpatient therapy group (1.80 vs. 1.97 in the inpatient and outpatient groups, respectively).

Conclusions: Our study results show that both therapy programs are effective, although the outpatient program is more cost-effective. Outpatient physical therapy program is encouraged, unless there are comorbid conditions requiring hospitalization.

This study is registered at ClinicalTrials.gov (retrospectively registered; date. 27.01.2021; NCT04736069).

Keywords: osteoarthritis, knee, physical therapy, cost-effectiveness

Introduction

Knee osteoarthritis (KOA) is a major public health concern with a heavy economic burden. According to a regional study conducted in Turkey, the prevalence of KOA among individuals over the age of 40 is 20.9% (1). In KOA patients, pain emerges as the primary symptom, resulting in physical, psychological dysfunction and, eventually, impaired quality of life (QoL) (2). Osteoarthritis (OA) is related with a high rate of work loss (3,4). Considering the high prevalence of KOA, it is not difficult to estimate the costs to both patients and society, which underlines the urgent need for cost-effective treatment strategies. Modifiable risk factors for KOA include obesity, dietary exposures, comorbidities, occupational factors, physical activity, and biomechanical factors (5). The therapeutic approach of KOA patients should be considered individually, and management should be based on evaluation from patient-basis combined measures. The non-pharmacological interventions in KOA include nutritional counseling for weight loss and exercise, management of comorbidities, and biomechanical support (5). The



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pharmacological treatments consist of basic analgesics or non-steroidal anti-inflammatory drugs, intra-articular glucocorticoids and, glucosamine/chondroitin sulfate in case of an inadequate response to oral analgesics (6). Pharmacological treatments are effective for both preventative and symptom-relieving goals (7,8). However, they are well known for their side effects. In particular, integrated rehabilitation programs are frequently used to improve patients' symptoms and QoL in the elderly population. Exercise programs and physical therapy programs are separately shown to have considerable benefits on pain and disability (9,10). However, the costs of these interventions are increasingly considered in the current health care policies for a more efficient utilization of resources. To date, several cost-effectiveness studies have been carried out for weight loss and exercise programs (11,12). A limited number of studies have investigated the cost-effectiveness of physical therapy and rehabilitation programs; however, conflicting results have been reported and, in these studies, different designs and outcome measures used prevent direct comparisons (12).

To the best of our knowledge, there is no head-to-head study comparing the effectiveness and costs of an integrated physical therapy program in the inpatient and outpatient settings. Estimating the rehabilitation programs' costs and utility may help clinicians to decide optimal treatment strategies with proper resource utilization. In the present study, therefore, we aimed to estimate the costs of both outpatient and inpatient rehabilitation programs and to assess the utility of those programs and compare the cost-effectiveness of both programs. This study addresses a significant gap in the literature by directly comparing the cost-effectiveness of identical physical therapy protocols in both inpatient and outpatient settings; an area that has not been previously evaluated in a head-to-head randomized design.

Materials and methods

Patients

A total of 60 consecutive KOA patients who referred to the physical therapy and rehabilitation outpatient clinic of our center between March 2011 and January 2013 and fulfilled the eligibility criteria were included in this prospective randomized study. The diagnosis of KOA was made based on the 2010 American College of Rheumatology (ACR) criteria (13). Exclusion criteria were uncontrolled hypertension, visual disturbances, pregnancy, malignancy, advanced cardiovascular, liver or kidney pathologies, having lower extremity injuries, inflammatory rheumatic diseases and prior total hip or knee arthroplasty surgery. The patients were randomized into two intervention groups. Basic randomization model was used for randomization. Each patient was instructed to select one of two sealed envelopes, each containing

an identical therapy program, but differing in whether the intervention would be delivered in an inpatient or outpatient setting. Group 1 (n=30) received 21 inpatient physical therapy sessions, including superficial-deep heat applications, electrotherapy, and a basic knee exercise program. Group 2 (n=30) received the same rehabilitation program in the outpatient setting. A written informed consent was obtained from each patient. The study protocol was approved by the local Ethics Committee (Date: 4.10.2010-No: 08043). The study was conducted in accordance with the principles of the Declaration of Helsinki. This study is registered at ClinicalTrials.gov (retrospectively registered; date. 27.01.2021; NCT04736069).

Physical Therapy interventions

The physical therapy program consisted of 20 min of hot pack, 20 min of transcutaneous electrical nerve stimulation (TENS; 30 to 40 Hz), and six min of ultrasound (US; 1 MHz, 1 to 1.5 Watt/cm²) therapy. A combined range of motion and strengthening exercises were performed by two groups two times a day. The rehabilitation program was administered to both groups under the supervision of physical therapists.

Outcome Measures

Pain and physical function were the primary outcomes of this study. The secondary outcome was the patients' QoL.

Pain: Pain intensity was measured with the Visual Analog Scale (VAS). The patients were asked to mark their pain level on a 10-cm horizontal line with terminal ends of 'No pain' and 'The worst pain.' The VAS was also used for the Patient Global Assessment (PGA) and Physician Global Assessment (MDGA). Physical function: Functional activity was evaluated with Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) (14,15). This questionnaire includes five items for pain, two for stiffness, and 17 for functional limitation (score range 0–68). All the items are scored on a scale of 0-4, with higher scores indicating a greater level of symptoms or physical disability. To measure the leg strength and endurance, we used the Chair Stand Test and Stair Climb Tests. During the Chair Stand Test, the patient is instructed to sit in a chair with arms crossed over his/her chest and stand up as quickly as possible without using arms (16). The patient is instructed to ascend and descend the stairs as fast, but as safe as possible for the Stair Climb Test, and the total time is recorded (17).

Fall risk assessment: The Hendrich II Fall Risk Scale was used to evaluate the fall risk. This scale consists of seven items including gender, depression, dizziness, confusion & disorientation, change in excretion, antiepileptic & benzodiazepine use, and get up and walk test. Patients having a score of ≥ 5 are considered at high risk (18).

QoL: The QoL was assessed using the ShortForm-36 (SF-36), which consists of eight multi-item scales: bodily pain, social functioning, physical functioning, role-emotional, role-physical, general health, mental health and vitality. Each score of these subscales ranges from 0 to 100. Higher scores indicate better QoL. The validation and reliability studies of the SF-36 were conducted in the Turkish population (19).

Costs

Costs covered by health resources and individual payments by patients during a six-month follow-up were calculated. The patients' outpatient services, diagnostic tests, and therapy expenses were calculated as direct healthcare costs, transportation expenses as direct non-medical costs, and work-loss days as indirect costs. The Turkish Social Security Institution (SGK) reimbursement rates were used to measure the cost per unit of tests and treatments. All measurements and all expenditures were assessed five times during the entire study: at before treatment (baseline), immediate post-treatment period, and post-treatment follow-up (at one, third, and six months). As the physical therapy interventions were conducted under the supervision of a physical medicine and rehabilitation specialist and a physiotherapist, treatment adherence was complete in both groups. However, eight patients were excluded from the final analysis due their inability to attend follow-up visits during the 6-month monitoring period.

Statistical and Cost-Effectiveness Analysis

Statistical analysis was performed using the SPSS for Windows version 20.0 software (IBM Corp., Armonk, NY, USA). Descriptive data were expressed in mean \pm standard deviation (SD), median (min-max) or number and frequency, where applicable. The independent samples t-test or Mann-Whitney U test was used to compare input and output patient characteristics, depending on the distribution of data set. The Pearson chi-square test was used to compare independent groups according to categorical variables. Differences between pre- and post-treatment values within each group were evaluated using the Wilcoxon signed-rank test. P value <0.05 was considered statistically significant.

The cost-effective analysis results were given as costs, total utility (TU), and incremental cost-effectiveness ratio (ICER). Total utilities were calculated from the VAS scores. To evaluate both patient- and physician-reported VAS scores, two VAS scores were weighted. A total of 40% of patient-reported VAS scores and 60% of physician-reported VAS scores were taken, and TU was calculated according to the weighted VAS score. Costs and total utilities of treatments were sorted in an ascending order. The least costly treatment was assigned as the baseline treatment. The ICER for each treatment

was calculated, considering the treatment coming after itself. In cost-effectiveness analysis, ICER is calculated for comparing non-dominated options. If a treatment has a greater TU and acceptable total cost, the ICER is obtained using the following formula: " $ICER_{Treatment-1/Treatment-2} = (Cost_{Treatment-1} - Cost_{Treatment-2}) / (TU_{Treatment-1} - TU_{Treatment-2})$ " To get TU over time for each patient, a specific utility estimator described by Yuksel et al. (20) was used. The MS Office Excel version 2018 software (Microsoft Corp., WA, USA) was used to calculate TU values.

Results

Of 60 patients, 52 completed the study. Of these patients, the mean age was 64.4 ± 13.3 years. Both groups had similar baseline characteristics including age, sex, marital status, comorbidities, occupation, trauma history and Kellgren Lawrence grade; except for body mass index (BMI) and education status. Radiologic scale of osteoarthritis was graded accordingly with the Kellgren Lawrence Scale as grade 0: No radiographic features of osteoarthritis are present; grade 1: Doubtful joint space narrowing and possible osteophytic lipping; grade 2: Definite osteophytes and possible joint space narrowing; grade 3: Moderate multiple osteophytes, definite joint space narrowing, some sclerosis, and possible deformity of bone ends; grade 4: Large osteophytes, marked joint space narrowing, severe sclerosis, and definite bone end deformity) (21). Baseline characteristics of the patients are summarized in Table 1.

At the end of the six-month follow-up period, the inpatient physical therapy group had a significant improvement in all parameters (VAS, PGA, MDGA, Stair Climb Test, Chair Stand Test, all WOMAC subscale scores, Hendrich II Fall Risk Score, and all SF-36 subscale scores) ($p < 0.05$). The outpatient physical therapy group had a significant improvement in all parameters ($p < 0.05$), except for the Chair Stand Test, WOMAC stiffness subscale, and SF-36 physical role functioning and emotional role functioning subscales ($p > 0.05$) (Table 2). There were no significant differences in the medication, medical equipment, intra-articular injections, complementary treatments, and laboratory and imaging expenses between the groups ($p < 0.05$). However, the initial costs and transportation costs were significantly different between the groups ($p < 0.05$) (Table 3).

The estimated total inpatient treatment cost was higher than the outpatient treatment group (inpatient=€1182.36; outpatient=€547.07). TU was higher in the outpatient treatment group (1.80 vs. 1.97 in the inpatient and outpatient groups, respectively). The ICER was calculated as 234.65 for outpatient rehabilitation program and 1714.89 for inpatient rehabilitation program, indicating that inpatient treatment was dominated by the outpatient treatment. According to the

Table- 1: Patient characteristics of the groups

		Group 1 (n=30) (inpatient therapy)	Group 2 (n=22) (outpatient therapy)	p value
Age (year) (Mean± SD)		66.8±12.2	61.0±14.1	0.120
Sex - female n (%)		27 (90)	16 (72.7)	0.144
Marital status - married n (%)		28 (93.3)	20 (90.9)	0.999
Education n (%)	Elementary School	25 (83.3)	11 (50.0)	0.042
	Middle School	2 (6.7)	3 (13.6)	
	High School	1 (3.3)	6 (27.3)	
	University	2 (6.7)	2 (9.1)	
BMI (kg/m ²) (Mean± SD)		30.2±4.0	26.8±4.3	0.006
Comorbidities (Hypertension, diabetes, thyroid diseases) n(%)		16 (53.3)	12 (54.5)	0.931
Occupation - working n (%)		1 (3.3)	4(18.2)	0.149
Occupational intensity n (%)	Heavy	0 (0)	1 (4.5)	0.202
	Moderate	2 (6.7)	4 (18.2)	
	Light	28 (93.3)	17 (77.3)	
Present Trauma history n (%)		6 (20.0)	5 (22.7)	0.999
Kellgren- Lawrence grading n (%)	Grade 1-2	10 (33.4)	14 (63.7)	0.143
	Grade 3	14 (46.2)	5 (22.7)	
	Grade 4	6 (20.0)	3 (13.6)	

n: number, BMI: body mass index, SD: standard derivation

cost-effective analysis, outpatient treatment program was more cost-effective.

Discussion

In the present study, we compared inpatient and outpatient physical rehabilitation programs for KOA. As our objectives were to compare the utility of the programs and analyze the overall expenses of a KOA patient for six months, no limitations were applied to the use of health resources. According to our results, both treatment strategies were effective in terms of improvement in the pain, physical function, and QoL scores; however, there was only a slight difference in the utility of each strategy. The cost-utility analysis showed that the physical therapy in the outpatient setting was more cost-effective, suggesting that the inpatient physical therapy program was effective, but was more costly.

The non-pharmacological treatment of OA consists of therapeutic exercise programs and lifestyle modifications (22). The main goals are to educate patients about the disease's course and its consequences, reduce joint pain and stiffness, improve joint mobility, prevent further damage, and increase QoL. According to Hurley et al. (23), intervention programs should carry several characteristics such as being safe, acceptable, and useful for patients, whereas being implantable and affordable for healthcare providers. Previous studies have addressed on the cost-effectiveness of physical activity and exercise programs, compared to usual care. The studies in-

vestigating the cost-effectiveness of physical activity and exercise programs showed that these interventions provided better health outcomes at lower costs (24-26). According to the data from the United Kingdom National Health Service (NHS) and the social services sector, the class-based exercise program resulted in lower costs and incremental quality-adjusted life-year (QALY) gains than home-based exercise alone (24,25).

The class-based program was under the supervision of a physiotherapist and consisted of stretching, balance training, and strengthening with functional and isometric exercises. In another study including 439 participants, the authors evaluated three months of aerobic exercise program and resistance exercise program at two centers and compared them with health education (26). Both programs resulted in lower costs and improved disability scores. Incremental improvement in self-reported disability scores was found to be of 0.18 and 0.16 for aerobic and resistance exercise, respectively, indicating that aerobic exercise had lower costs and a more significant benefit than resistance exercise. According to a recent study by Silva et al. (27), inactive KOA patients' attendance to a physical activity program could save 200 cases of cardiovascular disease, 400 cases of diabetes, and 6,800 QALYs. Until now, physical therapy interventions have been assessed regarding their cost-effectiveness in a limited number of studies with conflicting results. According to the study of Pinto et al. (28), manual therapy, exercise, and combined programs were cost-effec-

Table -2: Analysis of outcomes within the groups

		Group 1 (n=30) (inpatient therapy) median (min-max)						Group 2 (n=22) (outpatient therapy) median (minmax)					
		Pre-treatment	Post-treatment	1st month	3rd month	6th month	p	Pre-treatment	Post-treatment	1st month	3rd month	6th month	p value
VAS		8 (4-10)	5 (1-8)	4 (1-8)	4 (1-8)	3 (0-6)	<0.001	7 (3-10)	5 (0-8)	3 (0-8)	3 (0-7)	2 (0-8)	<0.001
Stair climb test		33 (9-134)	31 (10-132)	31 (13-129)	30 (11-132)	28 (9-127)	<0.001	46 (12-134)	42 (12-135)	44 (10-135)	41 (11-128)	40 (11-125)	<0.001
Chair stand test		4 (2-8)	4 (2-7)	4 (2-7)	4 (2-6)	4 (2-7)	0.007	5 (2-8)	4 (2-6)	4 (3-6)	4 (2-5)	4 (2-5)	NS
WOMAC Index	Pain	12 (7-18)	9 (3-16)	7 (3-15)	6 (1-16)	6 (1-12)	<0.001	14 (5-20)	10 (0-16)	9 (0-14)	8 (0-14)	9 (0-14)	<0.001
	Stiffness	2 (0-6)	2 (0-6)	2 (0-6)	2 (0-6)	2 (0-4)	0.019	3 (0-6)	3 (0-6)	2 (0-6)	2 (0-4)	2 (0-5)	NS
	Disability	21 (10-35)	16 (5-33)	14 (4-31)	12 (3-27)	11 (3-26)	<0.001	18 (9-36)	16 (0-30)	12 (0-30)	12 (0-20)	12 (0-20)	<0.001
	Function	20 (8-31)	14 (4-26)	12 (3-24)	10 (2-25)	10 (2-21)	<0.001	19 (8-31)	15 (0-27)	12 (0-24)	11 (0-19)	11 (0-17)	<0.001
	Total	55.5(26-88)	39.5 (16-77)	36.5 (12-76)	28.5 (7-71)	28(7-60)	<0.001	51 (23-93)	42(0-76)	35(0-74)	35 (0-53)	33 (0-57)	<0.001
Hendrich II Fall Risk Score		3 (0-6)	3 (0-5)	2 (0-4)	2 (0-4)	2 (0-4)	<0.001	3 (0-6)	1 (0-5)	1 (0-4)	1 (0-4)	1 (0-4)	0.008
SF-36	Bodily Pain	60 (0-80)	50 (0-90)	30 (0-90)	30 (0-70)	25 (0-70)	<0.001	60 (20-90)	50 (0-70)	30 (0-60)	30 (0-50)	20 (0-70)	<0.001
	General health	60 (0-80)	60 (0-80)	55 (0-80)	55 (0-80)	65 (35-100)	0.029	55 (25-75)	55 (40-75)	55 (40-85)	55 (40-75)	65 (40-90)	0.031
	Physical functioning	25 (0-75)	33 (0-90)	70 (0-90)	70 (0-90)	75 (15-95)	<0.001	65 (15-100)	75 (20-100)	80 (30-100)	80 (25-100)	80 (30-100)	0.010
	Vitality	50 (5-75)	55 (25-70)	55 (10-70)	55 (10-80)	63 (25-75)	<0.001	48 (20-85)	55 (35-70)	45 (30-70)	50 (35-70)	63 (40-70)	0.008
	Physical role functioning	88 (0-100)	0 (0-100)	88 (0-100)	88(0-100)	100 (0-100)	0.025	100 (0-100)	0 (0-100)	50 (0-100)	100 (0-100)	100 (0-100)	NS
	Emotional role functioning	0 (0-100)	33 (0-100)	100 (0-100)	100 (0-100)	100 (0-100)	0.001	67 (0-100)	100 (0-100)	100 (0-100)	100 (0-100)	100 (0-100)	NS
	Social role functioning	50 (13-75)	50 (13-75)	50 (13-75)	50 (0-75)	50 (13-100)	0.043	50 (25-100)	50 (38-75)	50 (25-75)	50 (25-75)	63 (25-100)	0.007

n: number, VAS: visual analog scale, min: minimum, max: maximum, WOMAC: Western Ontario and McMaster Universities, SF-36: Short Form-36, NS: non-significant (p>0.05)

tive, compared to usual care in the treatment of KOA. On the contrary, according to the study conducted by the Enabling Self-management and Coping with Arthritic Pain using Exercise (ESCAPE) knee pain group, the patients receiving a rehabilitation program had increased WOMAC function scores by 12% compared to baseline (22). The program was not cost-effective, when evaluated with QALYs, and the results did not differ whether the program was performed individually or in a group format. Shortly after, a modified rehabilitation program was evaluated by the ESCAPE-knee pain group, in which they added a booster session at four months to make the program more feasible and promote long-term adherence to exercise [28]. The modified ESCAPE-knee pain program was cost-saving, compared to usual physiotherapy; however, the benefits in the QALY and the increment in the WOMAC subscale scores did not reach a statistical significance. Two-year results of the Management of Osteoarthritis (MOA) trial also revealed that the exercise and manual physiotherapy interventions dominated usual care programs, whereas combined and

exercise physiotherapy did not, as assessed by the incremental net benefit (30).

Our study differs from the aforementioned studies in terms of objective and methodology. In the current study, we compared the cost-effectiveness of the same rehabilitation program given at in- and outpatient settings. Our study showed that both inpatient and outpatient combined physiotherapy rehabilitation programs effectively decreased pain and increased functional status, while the costs were lower in the outpatient rehabilitation program. The therapeutic benefits were sustained over the six-month follow-up in both groups. Notably, the inpatient group had a higher body mass index (BMI). As demonstrated by Waimann et al. (31), BMI is a strong predictor of treatment costs six months after total knee arthroplasty, surpassing even comorbidities in its impact. Similarly, in our study, the higher BMI levels might have contributed to the increased costs of the inpatient treatment group. In our study, the rate of comorbidities was similar between the groups. However, since we excluded advanced stages of comorbidities, we

Table-3: Comparison of direct and indirect costs between the groups

		Group 1 (n=30) (inpatient therapy)		Group 2 (n=22) (outpatient therapy)		p value
		Median	Min-Max	Median	Min-Max	
Direct medical costs	Physical therapy	473.8	473.8-901.3	180.3	180.3-227.5	<0.001
	Medication	8.9	0-16.3	9.2	0-17.0	NS
	Medical Equipment	0	0-49.8	0	0-51.1	NS
	Intra-articular injections	0	0-163.9	0	0-163.9	NS
	Complementary treatment	0	0-429.2	0	0-429.2	NS
	Laboratory & Imaging tests	0	0-25.7	0	0-6.0	NS
Direct non-medical costs	Transportation	5.1	1.3-33.5	43.8	13.3-76.8	<0.001
Indirect costs	Work loss	0	0-600.9	0	0-639.5	NS
Total costs		552.4	497.2-1372.5	276.3	218.0-1023.6	<0.001

* Values are expressed in Euros

cannot conclude its effect on expenses. Still, outpatient programs may be unsuitable for individuals with unstable clinical conditions. Therefore, patients with chronic conditions, who require a close follow-up, should be encouraged to attend to inpatient clinic programs. In our study, adherence to therapy was lower in the outpatient setting and a higher number of patients were lost during the follow-up. The high adherence rates in the inpatient setting can be attributed to the higher motivation of these patients.

Undoubtedly, the inpatient program would cost more than the outpatient program. However, the definition of cost-effectiveness differs according to several authors (32,33). In a systematic review, an intervention was accepted as cost-effective, if it was cheaper than the standard treatment; however, a more expensive intervention was also acceptable, if additional costs were not too high (12). Although the inpatient program was found to be costly in our study, significant effects were observed in all outcome parameters at six months of follow-up. Therefore, in our opinion, our study contributes to the literature in terms of showing the approximate expenses and profits of both approaches for health resource consumption in the mid- and long-term and may be a useful guide to decide on the most optimal physical therapy option for physicians.

In our study, although outpatient physical therapy program was more cost-effective, it was less effective in some parameters, such as Chair Stand Test, WOMAC stiffness subscale, and SF-36 physical and emotional role functioning subscales. Inpatient physical therapy program has certain advantages, such as treating physician visits two times a day and better patient adherence to the rehabilitation program. Learning self-directed exercises and medical device use under intense supervision

might have resulted in better education, self-care, and patient compliance to the OA therapy program in the long-term. Performing adequate, self-directed exercises may be ended with a more significant improvement in the muscle strength and endurance of the lower extremities, resulting in a better improvement in stiffness. Also, higher self-awareness of the patients may be helpful in the adaptation of their occupational and social roles. However, not all patients have access to inpatient facilities, particularly those living in rural areas. We believe that modification of risk factors, education of the patients about the disease, and well-designed exercise programs with adequate physical therapies in the outpatient clinics may be considered to be the optimal treatment strategy for most KOA patients, consistent with our results. Nonetheless, there are several limitations to this study. First, the sample size is relatively small and is not representative for a larger population. Second, although we used the blinded randomization model, working and less disabled patients refused hospitalization.

Thus, probably the randomization model did not completely prevent the bias. The main strength of this study is that the costs were calculated as an individualized patient-based method and, therefore, we could estimate the actual costs for every individual. According to previous studies, using the reimbursement method as a measure of cost, as in our study, is the preferred method. Second, the follow-up period was sufficient to interpret both treatment strategies' effects in the long-term in KOA patients. Also, there is no study available in the literature comparing cost-effectiveness of outpatient and inpatient physical therapy programs.

Conclusion

In conclusion, both inpatient and outpatient physical

therapy programs yielded significant improvements in pain, physical function, and quality of life in patients with knee osteoarthritis. However, the outpatient setting offered a more favorable cost-effectiveness profile. While inpatient care may benefit individuals with higher clinical complexity or adherence challenges, outpatient programs should be considered the first-line option for the majority of patients. This study provides novel evidence to guide efficient allocation of rehabilitation resources based on patient needs and health system constraints.

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