ΒΙΒΛΙΟΓΡΑΦΙΚΗ ΕΝΗΜΕΡΩΣΗ 2022

Άθληση και Οστεοαρθρίτιδα

ΕΜΜΑΝΟΥΗΛ ΜΠΡΙΛΑΚΗΣ

3η Ορθοπαιδική Κλινική

Νοσοκομείο ΥΓΕΙΑ

Αθήνα

My Disclosures

Board Member

Hellenic Association of Orthopaedic Surgery and Traumatology

Board Member

Hellenic Osteoporosis Foundation

Scientific Coordinator

Athens Shoulder Course

Committee member

ESA a section of ESSKA

Editorial Board

Journal of ISAKOS

Committee Deputy Chair

ISAKOS

Last updated
March 2022

Thank you for the kind invitation!

EEMMO

Διοικητικό Συμβούλιο Ε.Ε.Μ.Μ.Ο 2021 – 2022

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ΓΕΝ. ΓΡΑΜΜΑΤΕΑΣ	**Κοσμίδης** Χρήστος
ΤΑΜΙΑΣ	**Διονυσιώτης** Ιωάννης-Ελευθέριος
ΜΕΛΗ	**Ελευθεριάδου** Φοίβη-Αντιγόνη
ΜΕΛΗ	**Ποτούπνης** Μιχαήλ
ΜΕΛΗ	**Τουρνής** Συμεών

Οργανωτική Επιτροπή

Το Δ.Σ. της ΕΕΜΜΟ & οι

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Ανδρώνης Χρήστος
Ασράφ Χαμίντ
Γιαννουλάτος Χαράλαμπος
Καλτσονούδης Ευριπίδης
Καρακούσης Νικόλαος
Καραλής Δημήτριος
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Ξυμπτήρης Σταύρος
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Πέτρου Δημήτριος
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Σολωμός Παναγιώτης
Στασινός Παναγιώτης
Ταράσης Ιωάννης
Χρύσογλου Γεώργιος

Exercise for the management of Osteoarthritis

- ✓ Optimizes functional capacity and independence
- ✓ Increase joint stability and flexibility
- ✓ Reduce pain, improves function

Exercise for the management of Osteoarthritis

- ✓ Optimizes functional capacity and independence
- ✓ Increase joint stability and flexibility
- ✓ Reduce pain, improves function

Global health benefits of exercising

Bone health

Cardiovascular function

Energy metabolism

Insulin action

psychological status

Provide pleasure and entertainment

Exercise for the management of Osteoarthritis

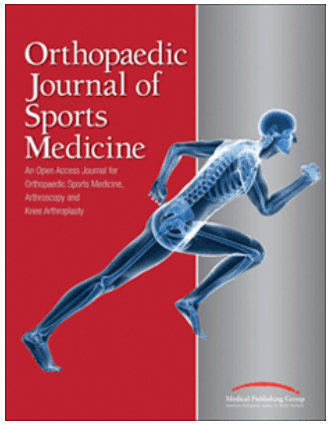
Vigorous physical activity has been found to **increase the risk of injury**, including joint injuries that can damage joint structures such as menisci, ligaments, and articular cartilage

1

Association of Sports Participation With Osteoarthritis

A Systematic Review and Meta-Analysis

Thomas Bestwick-Stevenson,*†‡ MRes, Onosi S. Ifesemen,† MPH, Richard G. Pearson,‡ PhD, and Kimberley L. Edwards,†‡ MMedSci, PhD, SFHEA
Investigation performed at the University of Nottingham, Nottingham, UK



2021

AIM

Examine the association between osteoarthritis (all joints) and participation in sports not included in previous reviews.

We hypothesized that there would be no difference in association of osteoarthritis among sports.

1

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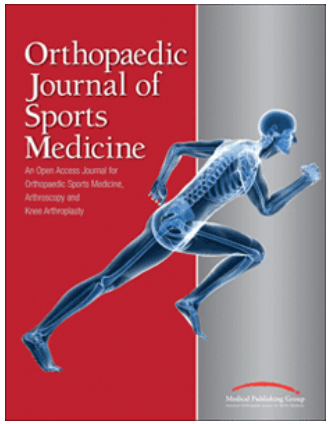

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- American football
- Archery
- Baseball
- Handball
- Wrestling
- Shooting
- Bobsleigh
- Curling
- Ice hockey
- Skeleton
- Speed Skating

1

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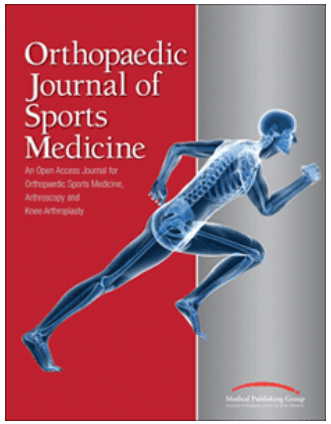

2021

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- American football
- ~~Archery~~
- ~~Baseball~~
- Handball
- Wrestling
- Shooting
- Bobsleigh
- ~~Curling~~
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1

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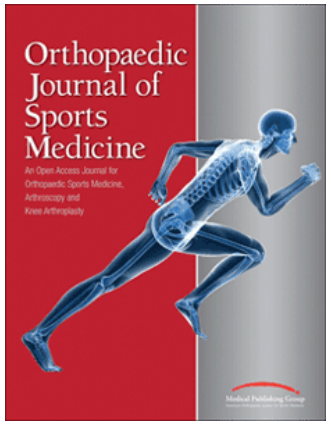

2021

Search No.	Search Term
1	osteoarthritis AND knee AND sport
2	osteoarthritis AND ankle AND sport
3	osteoarthritis AND back AND sport
4	osteoarthritis AND spine AND sport
5	osteoarthritis AND elbow AND sport
6	osteoarthritis AND shoulder AND sport
7	osteoarthritis AND neck AND sport
8	osteoarthritis AND hand AND sport
9	osteoarthritis AND American football/
10	osteoarthritis AND football/
11	osteoarthritis AND NFL/
12	osteoarthritis AND handball/
13	osteoarthritis AND ice hockey/
14	osteoarthritis AND wrestling/
15	osteoarthritis AND shooting/
16	osteoarthritis AND bobsleigh/
17	osteoarthritis AND baseball/
18	osteoarthritis AND archery/
19	osteoarthritis AND curling/
20	osteoarthritis AND speed skating/
21	osteoarthritis AND skeleton/
22	osteoarthrosis AND sport
23	osteoarthr* AND athlet*

Embase

SPORTDiscus

PEDro

MEDLINE

Title

Abstract

Manuscript

1

Association of Sports Participation With Osteoarthritis

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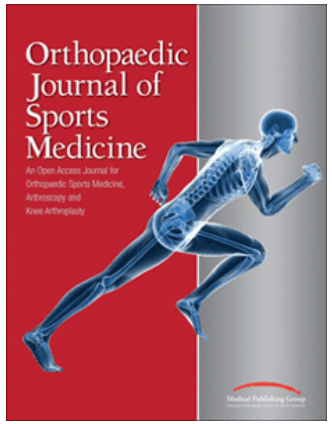

2021

Eligible studies

Case-control studies

Cohort studies, nested case-control studies

Randomized trials

Included adult participants (aged >18 years)

Measured exposure to any form of the sports of interest at any level and had a comparator group

Outcomes

Diagnosis of osteoarthritis
Radiographic markers of osteoarthritis
Arthroplasty of any joint
Self-reported chronic pain
Associated disability

Comparator groups

other sports
untrained participants without regular sporting exposure
military cohorts.

1

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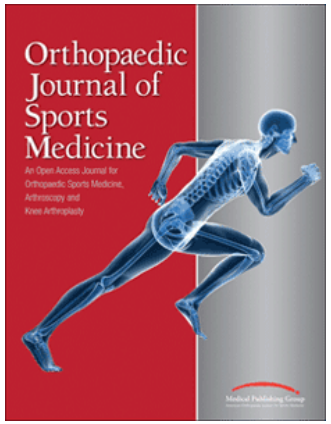


2021

Eligible studies

Case-control studies

Cohort studies, nested case-control studies

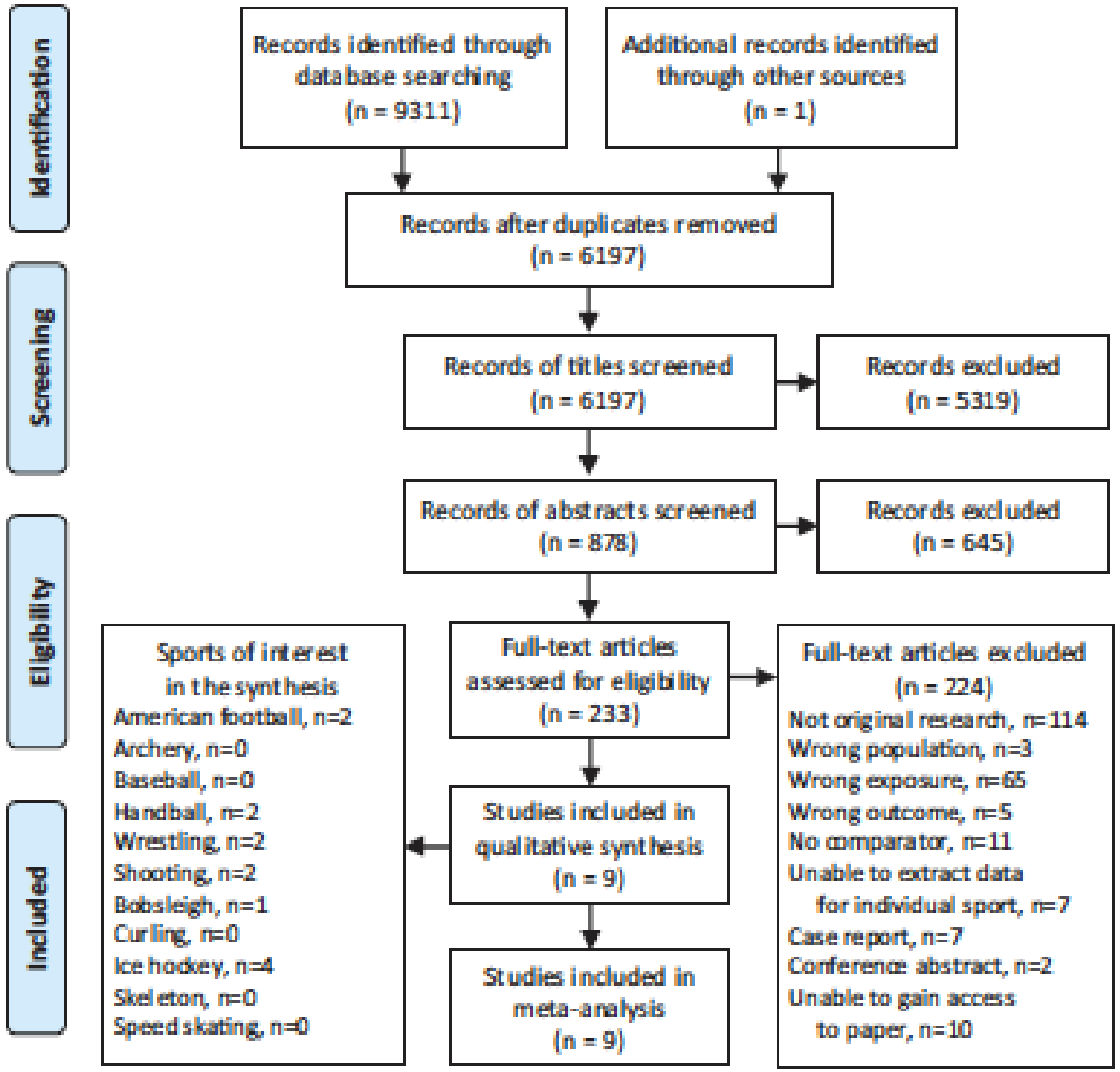
Randomized trials

Included adult participants (aged >18 years)

Exclusion Criteria

The sport could not be identified
Exposure to a combination of sports
< 1 year).

Animal studies
Studies that involved amputees
Case series (with no comparator)
Case reports were excluded.


Identification
Screening
Eligibility
Included
Records identified through database searching (n = 9311)
Additional records identified through other sources (n = 1)
Records after duplicates removed (n = 6197)
Records of titles screened (n = 6197)
Records excluded (n = 5319)
Records of abstracts screened (n = 878)
Records excluded (n = 645)
Full-text articles assessed for eligibility (n = 233)
Full-text articles excluded (n = 224)
Not original research, n=114
Wrong population, n=3
Wrong exposure, n=65
Wrong outcome, n=5
No comparator, n=11
Unable to extract data for individual sport, n=7
Case report, n=7
Conference abstract, n=2
Unable to gain access to paper, n=10
Studies included in qualitative synthesis (n = 9)
Sports of interest in the synthesis
American football, n=2
Archery, n=0
Baseball, n=0
Handball, n=2
Wrestling, n=2
Shooting, n=2
Bobsleigh, n=1
Curling, n=0
Ice hockey, n=4
Skeleton, n=0
Speed skating, n=0
Studies included in meta-analysis (n = 9)

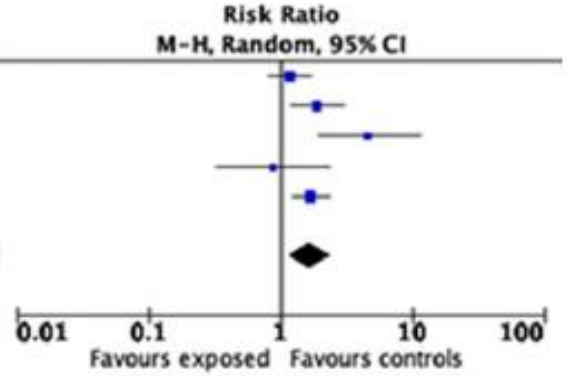
HIP

RR =1.67
P=0,007

A

Study or Subgroup	Exposed Events	Exposed Total	Controls Events	Controls Total	Weight	Risk Ratio M-H, Random, 95% CI
Kettunen et al. 2001 (47)	25	213	386	3861	26.4%	1.17 [0.80, 1.72]
Kujala et al. 1994 (51)	19	419	155	6485	23.2%	1.90 [1.19, 3.02]
L'Hermette et al. 2006 (54)	12	20	5	39	11.7%	4.68 [1.92, 11.43]
Marti et al. 1989 (63)	3	9	19	50	10.1%	0.88 [0.33, 2.36]
Tveit et al. 2012 (90)	34	206	350	3612	28.6%	1.70 [1.23, 2.35]
Total (95% CI)		867		14047	100.0%	1.67 [1.15, 2.41]
Total events	93		915			

Heterogeneity: $Tau^2 = 0.10$; $Chi^2 = 10.17$, df = 4 (P = 0.04); $I^2 = 61\%$
Test for overall effect: Z = 2.70 (P = 0.007)



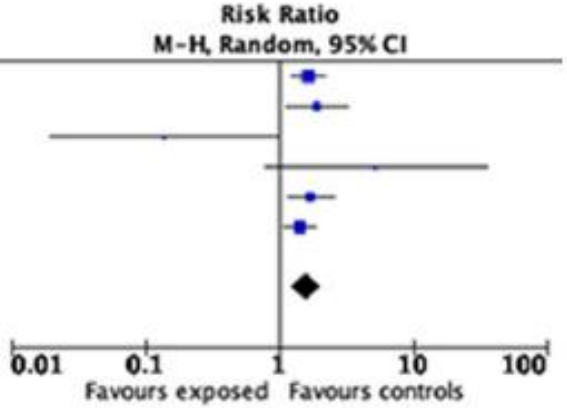
KNEE

RR =1.60
P<0,001

B

Study or Subgroup	Exposed Events	Exposed Total	Controls Events	Controls Total	Weight	Risk Ratio M-H, Random, 95% CI
Kettunen et al. 2001 (47)	42	210	462	3816	29.4%	1.65 [1.24, 2.19]
Kujala et al. 1994 (51)	15	419	121	6485	15.9%	1.92 [1.13, 3.25]
Kujala et al. 1995 (52)	1	29	22	88	1.7%	0.14 [0.02, 0.98]
Moretz et al. 1984 (68)	11	23	1	11	1.8%	5.26 [0.77, 35.77]
Thelin et al. 2006 (87)	58	338	29	293	21.0%	1.73 [1.14, 2.63]
Tveit et al. 2012 (90)	44	206	540	3638	30.2%	1.44 [1.09, 1.89]
Total (95% CI)		1225		14331	100.0%	1.60 [1.23, 2.08]
Total events	171		1175			

Heterogeneity: $Tau^2 = 0.04$; $Chi^2 = 8.82$, df = 5 (P = 0.12); $I^2 = 43\%$
Test for overall effect: Z = 3.54 (P = 0.0004)



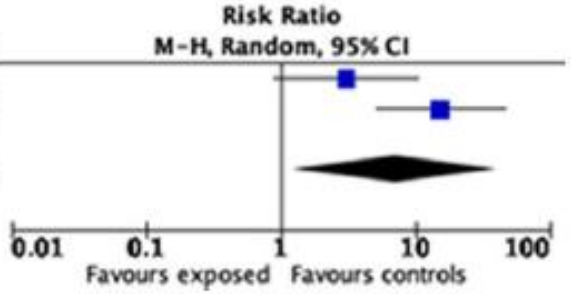
ANKLE

RR =7.08
P=0,03

C

Study or Subgroup	Exposed Events	Exposed Total	Controls Events	Controls Total	Weight	Risk Ratio M-H, Random, 95% CI
Kujala et al. 1994 (51)	3	419	15	6485	48.7%	3.10 [0.90, 10.65]
Vincelette et al. 1972 (92)	55	59	3	50	51.3%	15.54 [5.18, 46.64]
Total (95% CI)		478		6535	100.0%	7.08 [1.24, 40.51]
Total events	58		18			

Heterogeneity: $Tau^2 = 1.23$; $Chi^2 = 4.45$, df = 1 (P = 0.03); $I^2 = 78\%$
Test for overall effect: Z = 2.20 (P = 0.03)



ALL 6 SPORTS

Ice Hockey

HIP OSTEOARTHRITIS

Elite other sports

Military

Other

Military

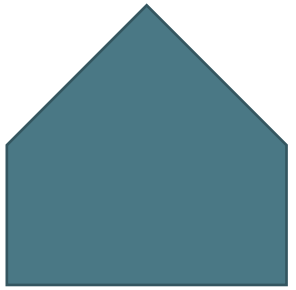
Other

KNEE OSTEOARTHRITIS

Elite other sports

Military

Other

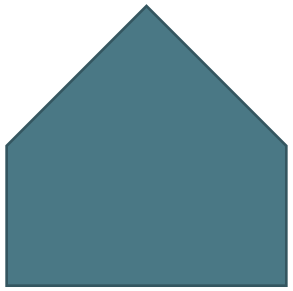


Military

Other

Wrestling

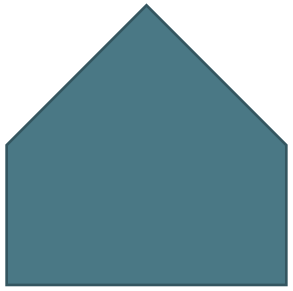
HIP OSTEOARTHRITIS



Elite other sports

Military

Other



Military

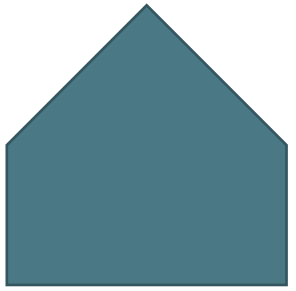
Other

KNEE OSTEOARTHRITIS

Elite other sports

Military

Other

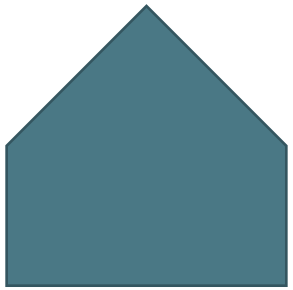


Military

Other

Handball

HIP OSTEOARTHRITIS



Elite other sports

Military

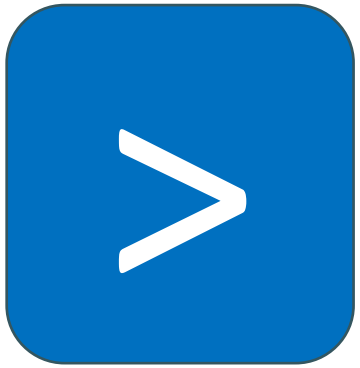
Other

Military

Other

Shooting

Conclusions



Risk of Osteoarthritis From the Included Sports

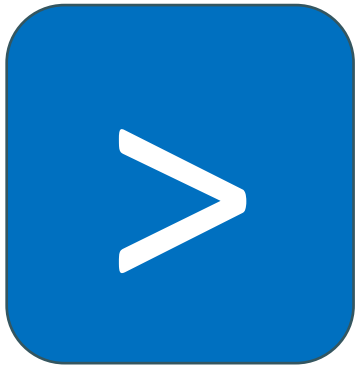
Participation in the sports in this review (ice hockey, wrestling, handball, shooting, American football, and bobsleigh) was associated with a higher risk of developing osteoarthritis of the hip, knee, and ankle when compared with controls.

ANKLE > HIP = KNEE

Wrestling and Ice hockey

- Increased risk of developing knee osteoarthritis when compared with controls (other sports and no sports)
- Higher risk of hip osteoarthritis versus controls including other sports.
- Not associated with a significant risk of developing hip osteoarthritis compared with controls with no sports

Conclusions



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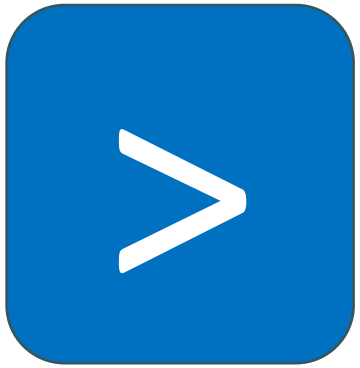
ANKLE > HIP = KNEE

Handball

- Was associated with hip osteoarthritis when compared with controls with no other sports
- No significant difference between handball players and controls when included other sports

Conclusions



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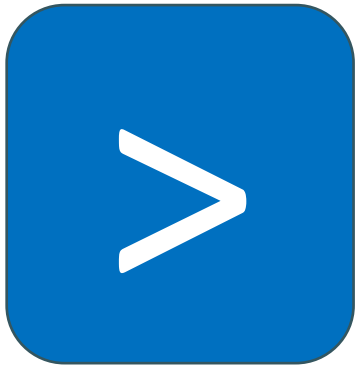
ANKLE > HIP = KNEE

Shooting

- Did not have a statistically significant risk of knee osteoarthritis

Conclusions



Risk of Hip Osteoarthritis From the Included Sports

Participation in handball, ice hockey, and wrestling produces an increased risk of developing hip osteoarthritis

When the controls included sports for wrestling and ice hockey and no sports for handball

- Handball, ice hockey, and wrestling are all sports that involve high impact and torsion of the lower limbs

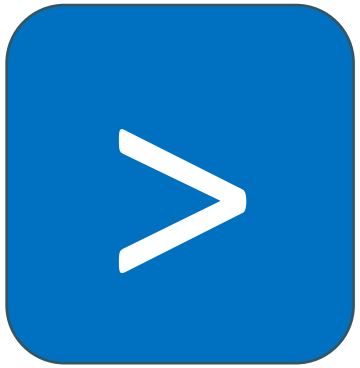
Minor hip injuries

Muscle fatigue and groin pain

Leading to stiffening and osteoarthritis of the hip

Femoro-acetabular impingement

Conclusions



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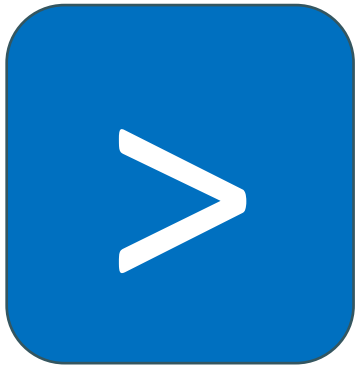
When the controls included sports for wrestling and ice hockey and no sports for handball

- Handball, ice hockey, and wrestling are all sports that involve high impact and torsion of the lower limbs

Handball -> joint loading during play has been measured above the physiologic limits of cartilage

Requires rapid stoppages, accelerations, and cutting movements

Conclusions



Risk of Hip Osteoarthritis From the Included Sports

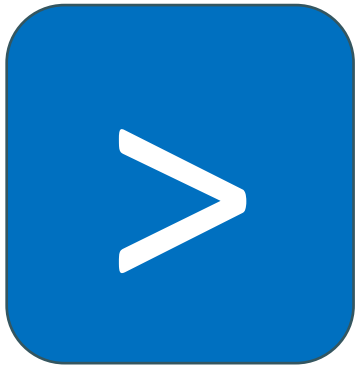
No significant difference in the risk of sustaining hip osteoarthritis from wrestling and ice hockey participation

When the controls included no sports and handball participation when the controls included sports.

One reason for this could be the global health benefits, including bone health, that sports and exercise provide.

Similarly, exercise can increase joint stability and flexibility as well as reduce pain, thus optimizing functional capacity.

Conclusions



Risk of Knee Osteoarthritis From the Included Sports

Wrestling and ice hockey participation produces an increased risk of developing knee osteoarthritis.

Injuries (high risk of sustaining an injury)

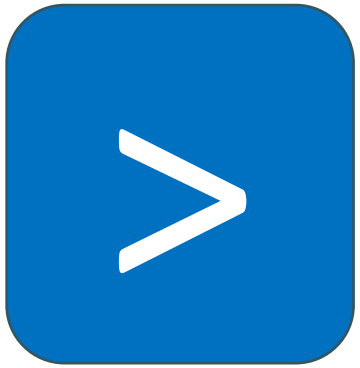
Professional athletes have a higher proportion of varus knee alignment than does the general population

Wrestling

Heavyweight training

Non-physiologic rotational loading and injuries among wrestlers

Conclusions



Risk of Knee Osteoarthritis From the Included Sports

Wrestling and ice hockey participation produces an increased risk of developing knee osteoarthritis.

Injuries (high risk of sustaining an injury)

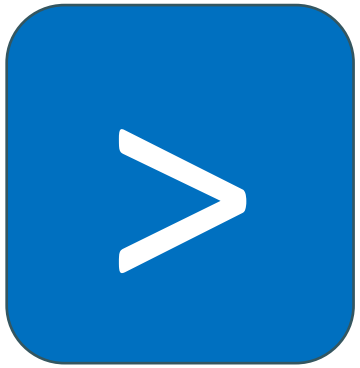
Professional athletes have a higher proportion of varus knee alignment than does the general population

Shooting

Lower risk

Low risk of sustaining an injury from shooting

Conclusions



Health Benefits of Sport and Physical Activity

Sports participation still provides health benefits, such as bone health, cardiovascular function, energy metabolism, insulin action, and psychological status

Limitations

- Small samples
- Male athletes
- Differing methods for diagnosis

Journal of *Clinical Medicine*

MDPI

Review

The Role of Physical Activity as Conservative Treatment for Hip and Knee Osteoarthritis in Older People: A Systematic Review and Meta-Analysis

Biagio Zampogna [1,*], Rocco Papalia [1], Giuseppe Francesco Papalia [1], Stefano Campi [1], Sebastiano Vasta [1], Ferruccio Vorini [1], Chiara Fossati [2], Guglielmo Torre [1] and Vincenzo Denaro [1]

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2020

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To determine the efficacy of physical activity as a conservative treatment for elderly people with knee or hip OA.

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To assess the effect on pain, physical function, stiffness, quality of life, and dynamic balance outcomes of different active exercise and sports.

Secondary endpoint

To establish the specific benefits on the selected outcomes of the single intervention, to try to evaluate if there is an exercise or sport that leads to better enhancement in physical capacity and quality of life of older osteoarthritic adults.

Studies Included

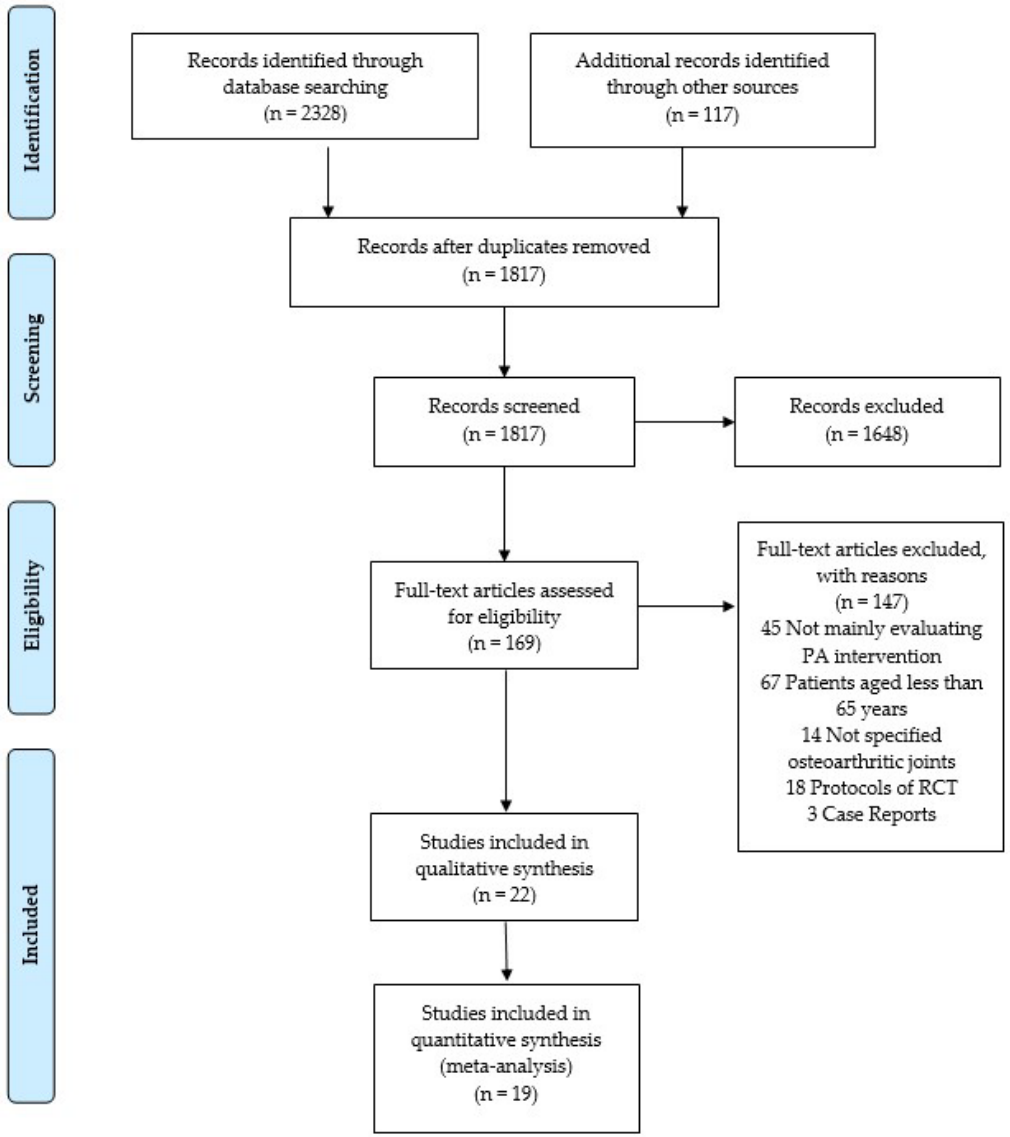
Randomized clinical trial, observational studies, or case series, which evaluated the role of sport or exercises as a conservative treatment for patients aged 65 or over with all degrees of the knee and hip OA.

Demographic Data

The overall number of participants: 1504 (intervention or control groups)

Mean age ranged from 65 to 78.9 years.

All studies showed a higher female percentage BMI ranged between 23.7 and 33.6



Pain

Assessed by WOMAC pain and KOOS pain scale

COMPARISON BETWEEN	SIGNIFICANT DIFFERENCES	HETEROGENEITY
Aquatic exercises vs Land-based exercises	NO	NO
Aquatic exercises vs Control group	YES	HIGH
Land-based exercises vs Control group	NO	NO
Tai Chi vs Control group	YES	MODERATE
Yoga vs Control group	YES	NO

Function

Assessed by WOMAC physical function and KOOS ADL

COMPARISON BETWEEN	SIGNIFICANT DIFFERENCES	HETEROGENEITY
Aquatic exercises vs Land-based exercises	NO	NO
Aquatic exercises vs Control group	YES	NO
Land-based exercises vs Control group	YES	HIGH
Tai Chi vs Control group	YES	LOW
Yoga vs Control group	YES	NO

Quality of Life

Assessed by KOOS QOL and SF-12

COMPARISON BETWEEN	SIGNIFICANT DIFFERENCES	HETEROGENEITY
Aquatic exercises vs Land-based exercises	NO	MODERATE
Aquatic exercises vs Control group	YES	MODERATE
Land-based exercises vs Control group	NO	NO

Stiffness

Assessed by WOMAC stiffness scale

COMPARISON BETWEEN	SIGNIFICANT DIFFERENCES	HETEROGENEITY
Aquatic exercises vs Control group	NO	NO
Land-based exercises vs Control group	NO	NO
Tai Chi vs Control group	YES	MODERATE
Yoga vs Control group	YES	NO

Dynamic Balance

Assessed by Time Up and Go test

COMPARISON BETWEEN	SIGNIFICANT DIFFERENCES	HETEROGENEITY
Aquatic exercises vs Control group	YES	LOW

Conclusions

Physical activity has shown to be very beneficial for older people with knee and hip OA in terms of pain reduction, better function, performance, and quality of life, with statistically significant improvements compared to the control group.

Nevertheless, it was not possible to determine with certainty greater long-term benefits of one type of physical activity compared to the others, also considering the different rates of adherence, and adverse events.

3

Physical therapy for patients with knee and hip osteoarthritis: supervised, active treatment is current best practice

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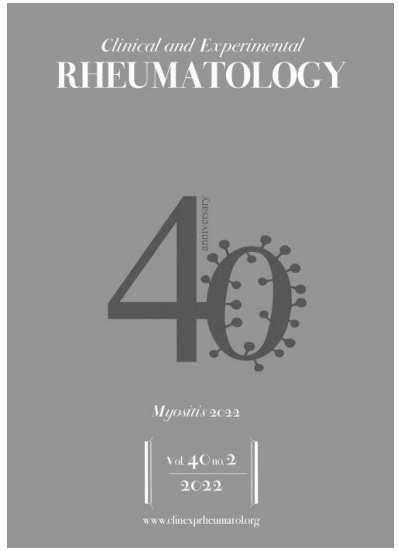
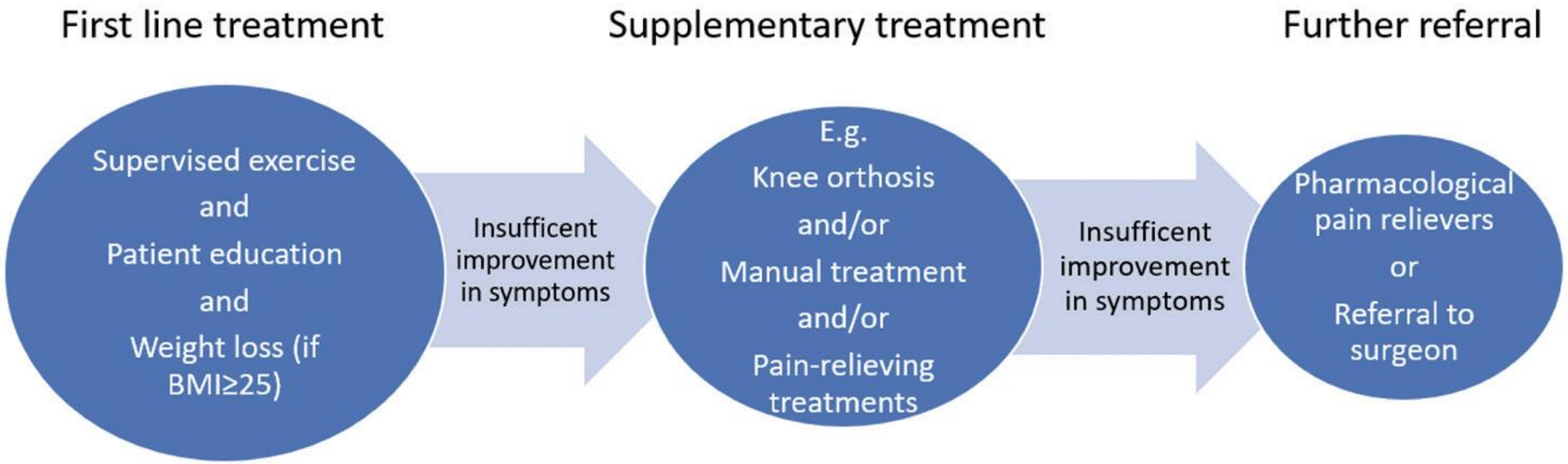
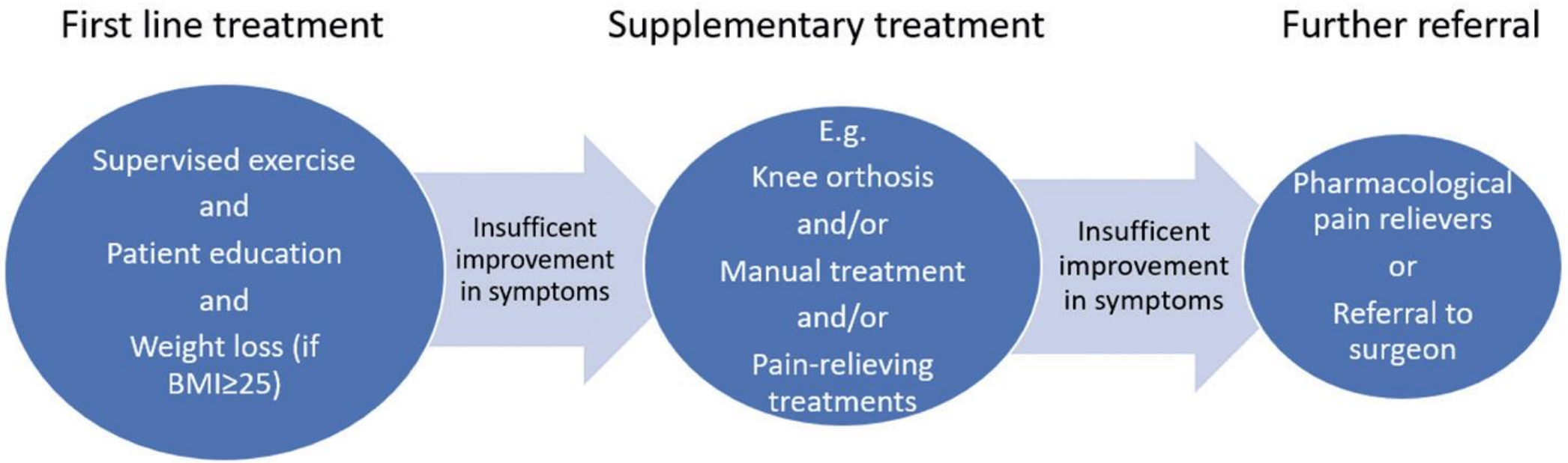


2019

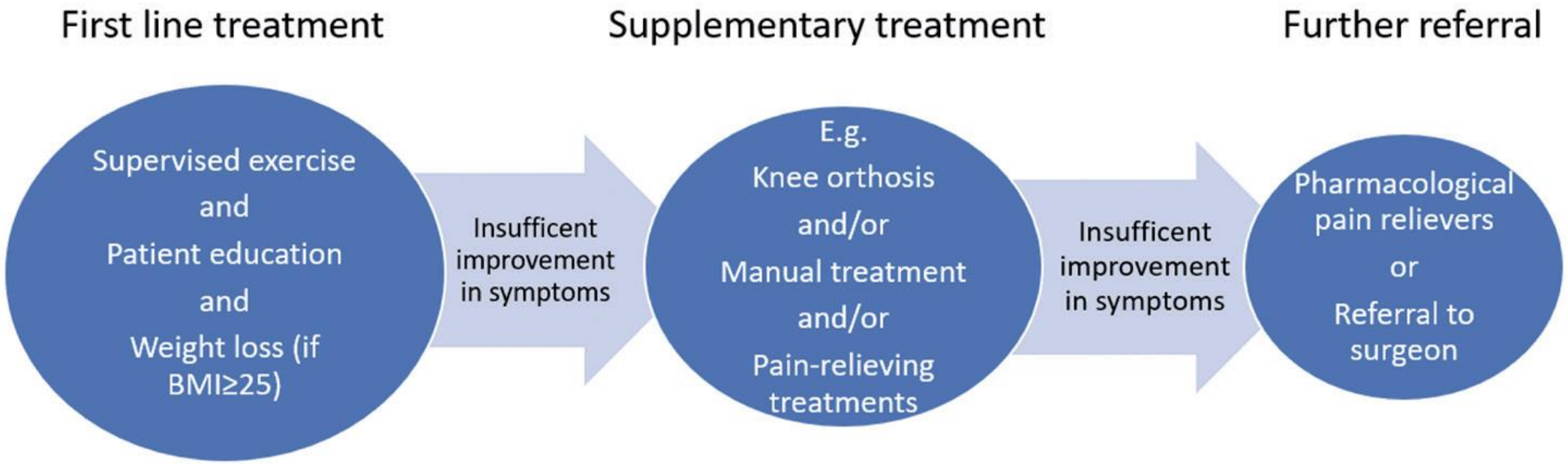

First line treatment
Supplementary treatment
Further referral
Supervised exercise and Patient education and Weight loss (if BMI≥25)
Insufficent improvement in symptoms
E.g. Knee orthosis and/or Manual treatment and/or Pain-relieving treatments
Insufficent improvement in symptoms
Pharmacological pain relievers or Referral to surgeon



Exercise therapy

Based on 54 randomized controlled trials (knee) and 12 (hip) the last 25 years

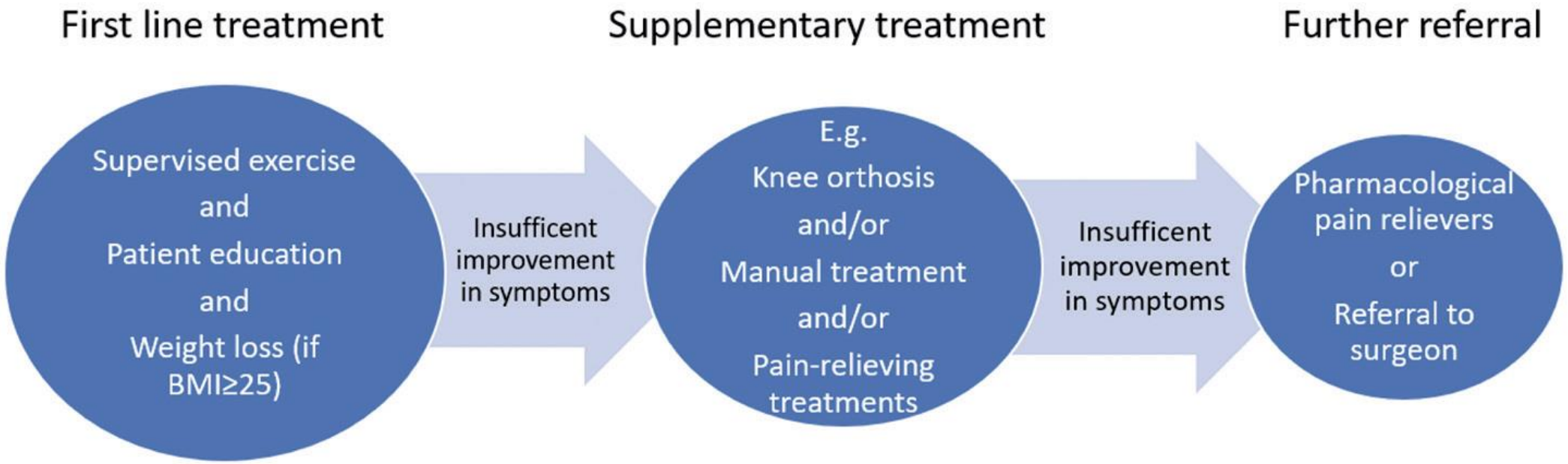
- Pain and physical function are improved significantly following a supervised exercise intervention in patients with knee and hip OA.
- Larger effect on both pain (effect size of 0.49 vs. 0.38) and function (effect size of 0.52 vs. 0.38) in knee OA patients compared with hip OA patients.



Exercise therapy

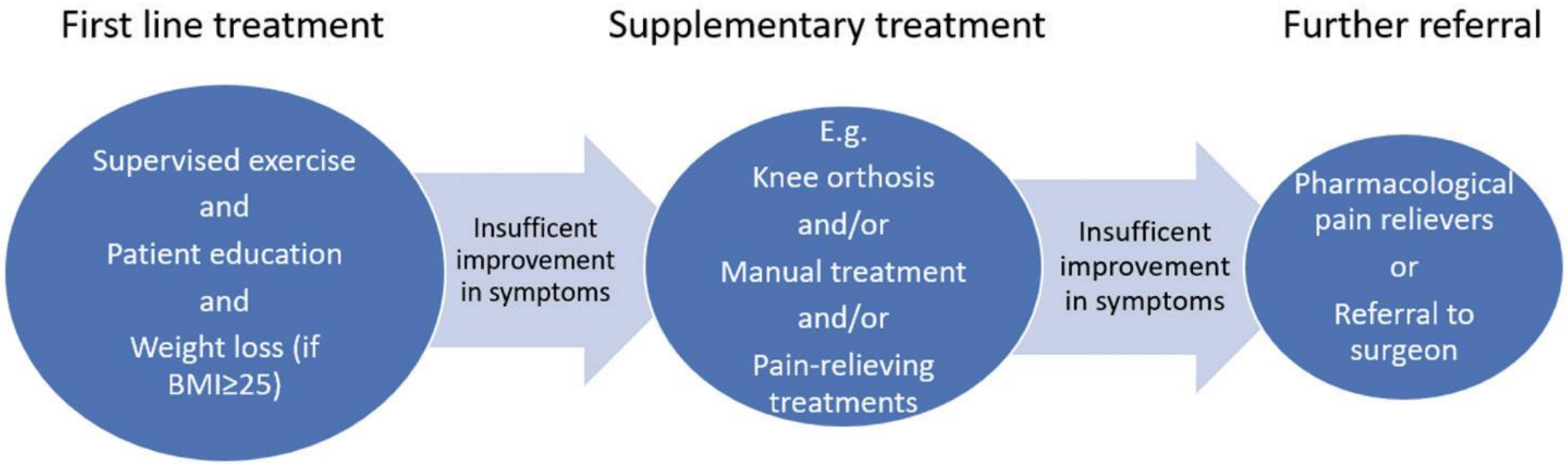
Based on 54 randomized controlled trials (knee) and 12 (hip) the last 25 years

- Although the treatment effect is slightly smaller, water-based exercise may offer a viable alternative, if the patient is unable to perform land-based exercises, due to, for example, intolerable symptoms from loading the joint and/or severe obesity.



Exercise therapy as painkiller

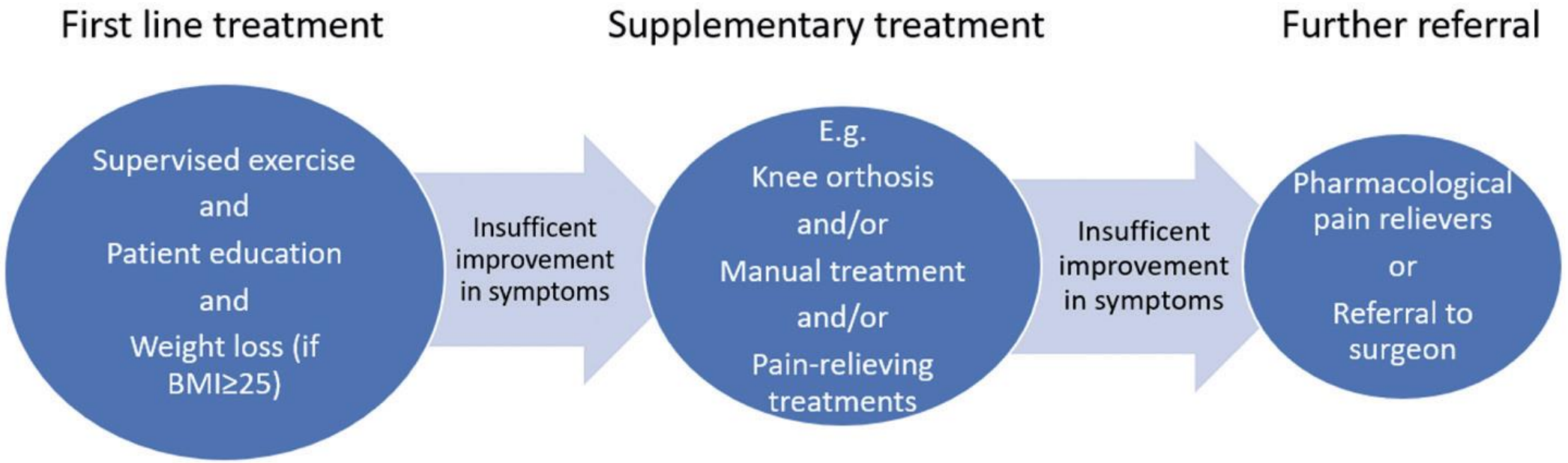
- The effects of exercise therapy and physical therapy in general are not associated with radiographic severity of knee OA or the degree of pain that the patients experienced before the treatment
- In 95% of the patients with knee or hip OA awaiting total joint replacement, one-hour twice weekly weight-bearing exercise sessions were performed with no more than acceptable pain



Individualization of exercise programs

Aerobic | Resistance | Performance exercise

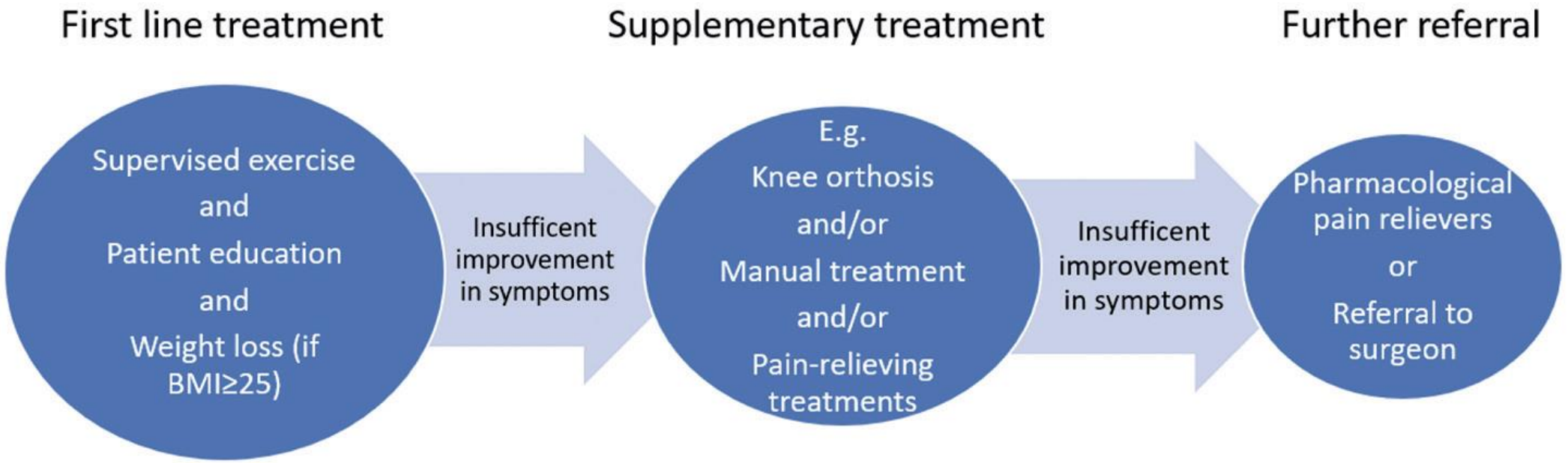
- Effects are similar for these three subgroups
- Patients with varus thrust may benefit more from a neuromuscular exercise programme
- Patients with a BMI of 30 or more may benefit more from quadriceps strengthening



Individualization of exercise programs

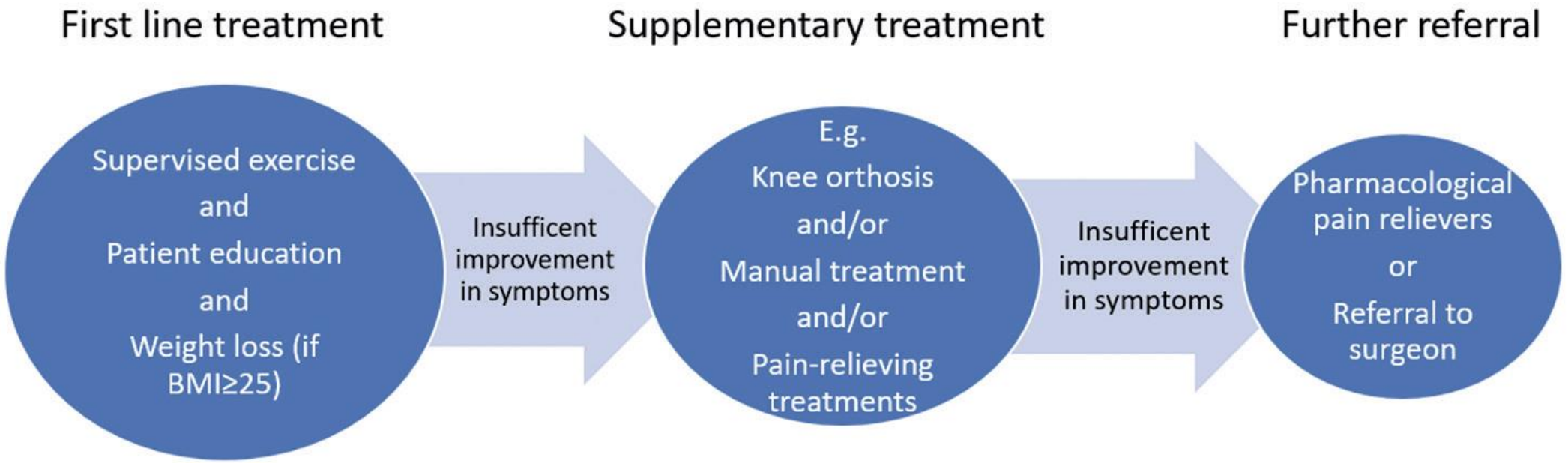
Supervision and dose

- It appears that a minimum of 12 supervised sessions is more effective compared to fewer than 12 sessions among knee OA patients



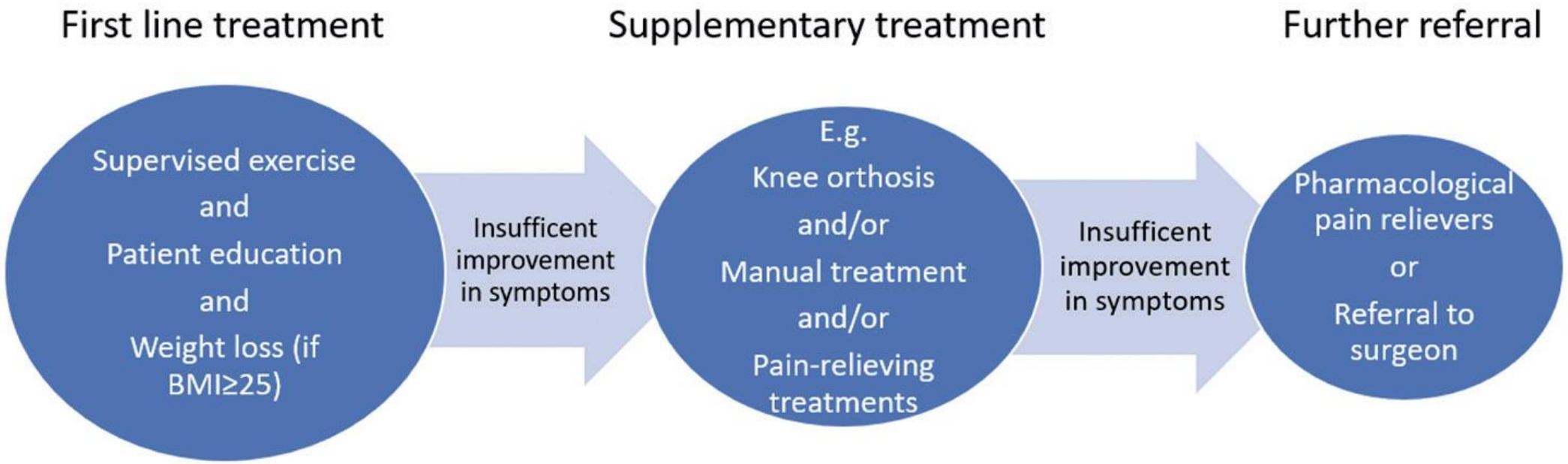
Combined effect of exercise with other modalities

- Combined treatment plan of exercise and weight loss is more effective in improving pain and physical function in overweight knee OA patients than either exercise and weight loss alone



Patient education + follow up

- Patient education alone may have only a small effect on pain and function
- Patient education combined with follow-up sessions after the completion of the programme, may be key to increasing self-efficacy and retaining motivation and adherence to an exercise programme and thus maintaining benefit in OA patients



Patient education

- Information about causes, risk factors and disease mechanisms
- The importance of physical activity and consequences of inactivity
- Effective and ineffective treatments and strategies
- Understanding how to manage pain and exercise-induced pain flares
- Motivate him or her to life-long exercise and physical activity

Recommendations

Table I. Eight exercise recommendations for knee and hip OA.

Number	Recommendation
1	Offer the patient supervised, progressive aerobic, resistance or performance exercise tailored to the patient's needs, preferences and characteristics.
2	Consider water-based exercises if the patient is unable to perform land-based exercises, especially during the initial part of the programme.
5	After an adjustment period, and if symptoms allow it, consider three weekly sessions to increase the effect.
6	Offer patient education to improve compliance and long-term effects.
7	Consider follow-up sessions after the programme to improve compliance and long-term effects.
8	Consider supplementary treatment such as knee orthoses and manual treatment if the intervention shows no effect.

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BMC Musculoskeletal Disorders

RESEARCH ARTICLE Open Access

The effects of a home-based exercise intervention on elderly patients with knee osteoarthritis: a quasi-experimental study

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2019

AIM OF THIS RANDOMIZED CONTROL TRIAL

To evaluate the effectiveness of a home-based exercise intervention (HBEI) program for older patients with Knee OA.

Hypothesis

It would relieve patients' symptoms at week 12 (pain and stiffness)

Improve their physical functioning and quality of life

compared to a health-education intervention.

Inclusion criteria

- 60 years of age or older
- Experiencing knee pain on most days of the past month
- Average knee pain in the last week between 3 and 7 on an 11-point numeric rating scale (NRS)
- Having intact cognitive functioning

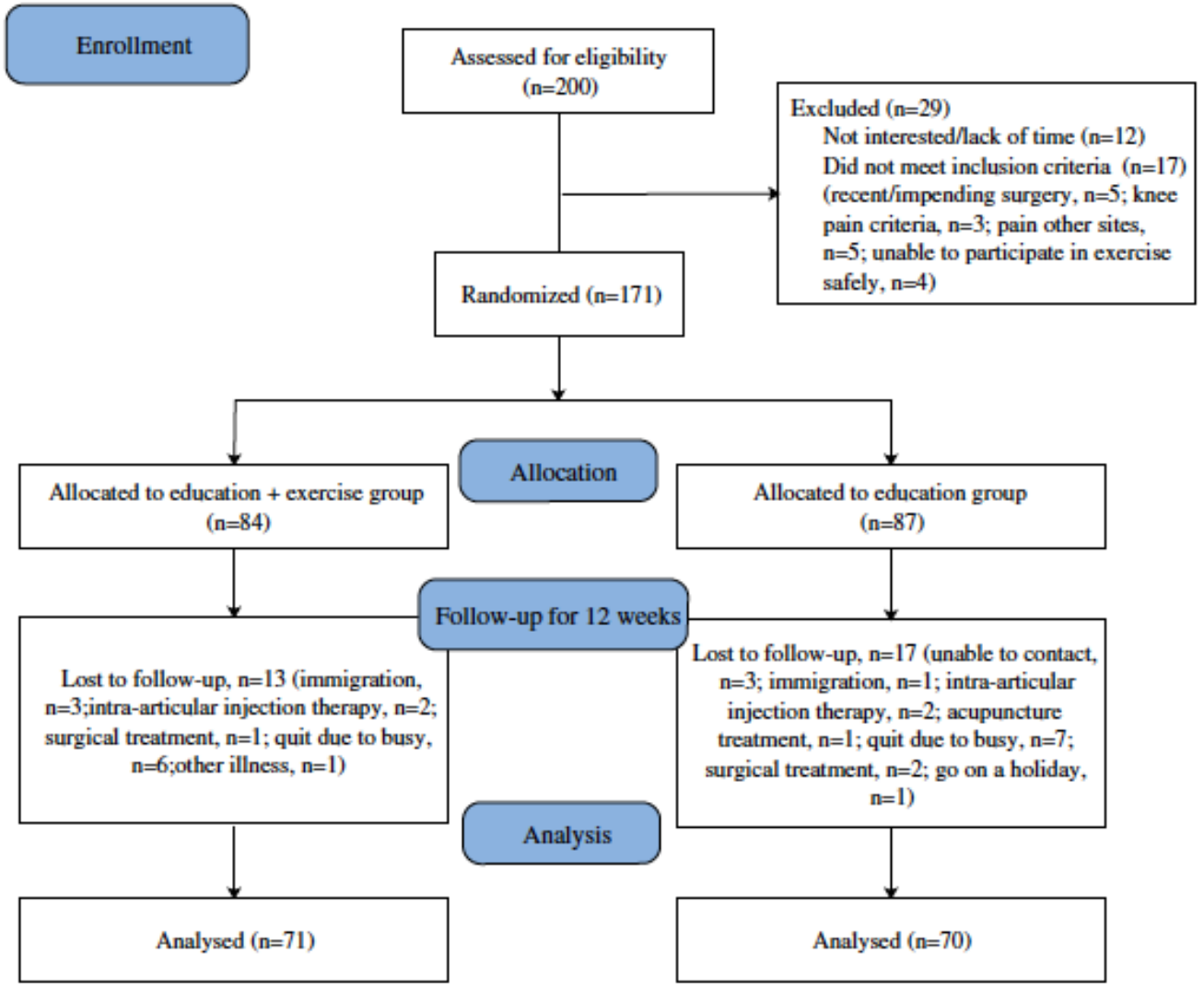
  Short Portable Mental Status Questionnaire score of 8–10 (0–10)

Exclusion criteria

- Joint replacement surgery or arthroscopic surgery on the affected side of the knee
- Other surgery on lower limbs within the past 6 months
- Severe deformity of lower limbs
- Having health problems that can easily induce adverse events during home exercise

  such as uncontrolled high blood pressure, a myocardial infarction, cerebral infarction, unstable angina, arrhythmia, severe vision problems, or neurological dysfunction.

Study design



Study design

Intervention group

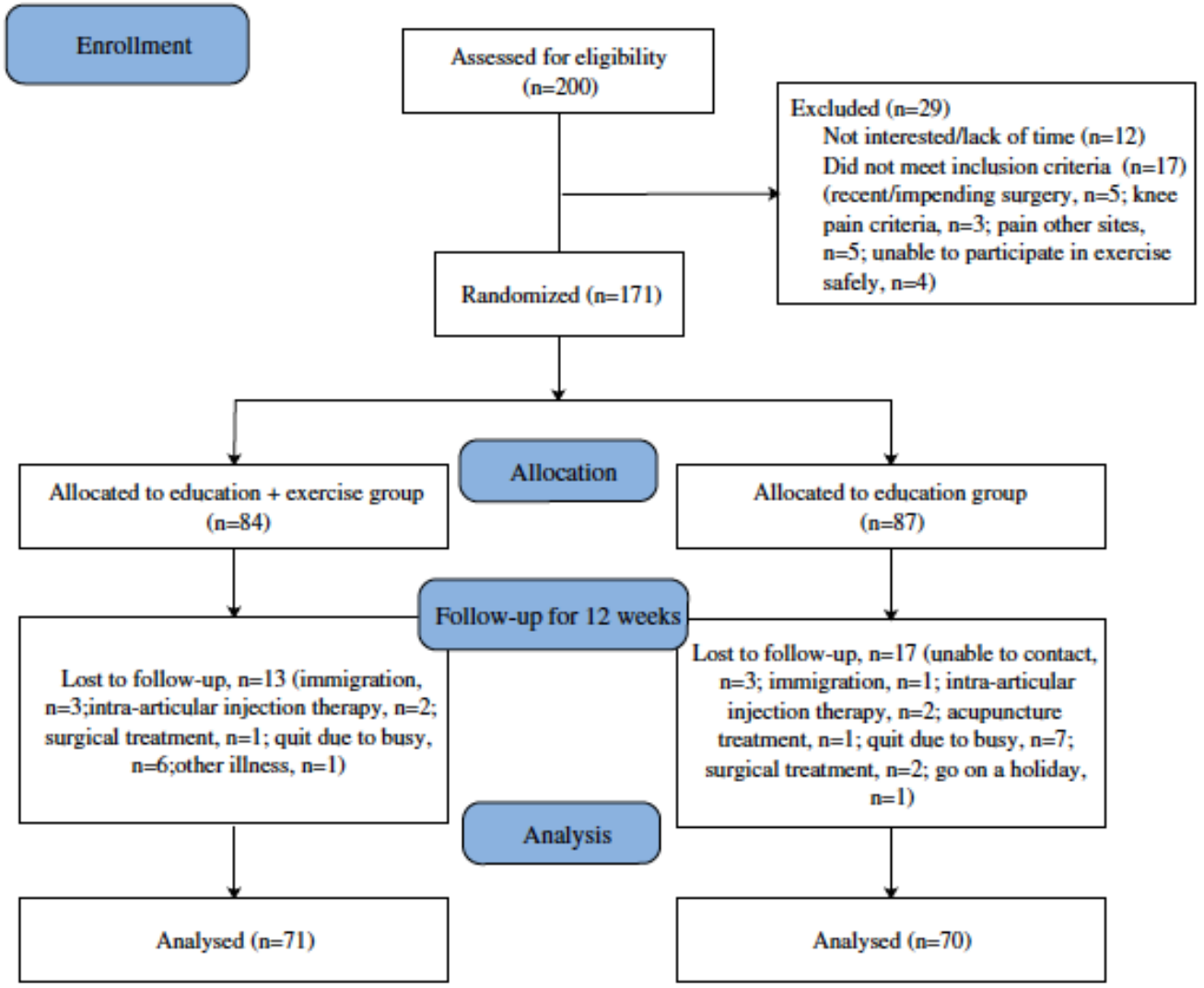
Four 2-h sessions conducted by physiotherapists over 12 weeks (weeks 0, 2, 4, and 6)

Each session, which was conducted in groups of 6–12 patients, included an hour for health education and an hour for exercise.

Participants also performed home-based practice during the study.

Home-exercise diary

Research assistants telephoned



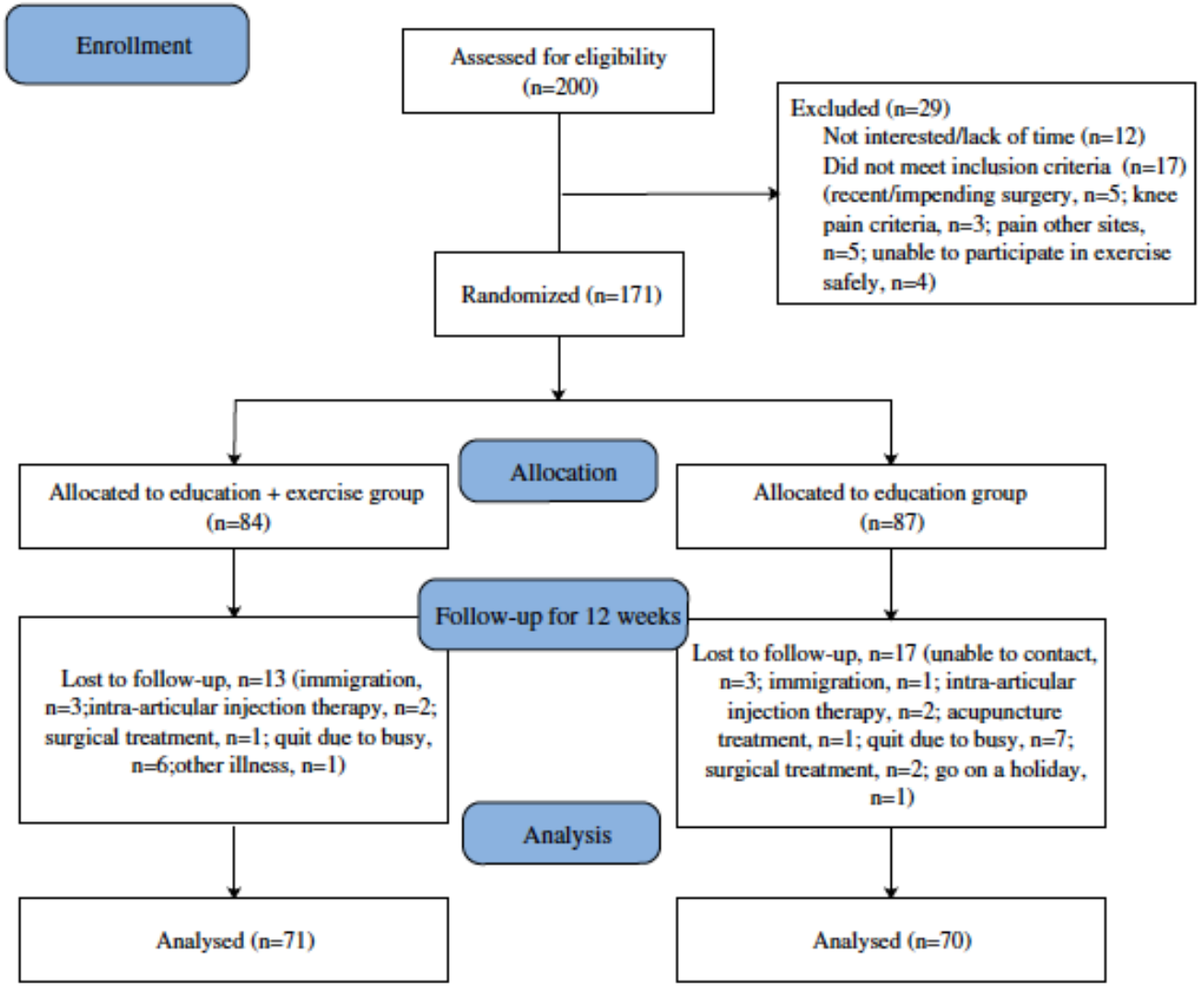
Study design

Control group

Health education with four 1-h sessions conducted by physiotherapists over 12 weeks (weeks 0, 2, 4, and 6)

Information about clinical manifestations, risk factors, clinical examination and diagnosis, treatment and nursing care for KOA, the benefits of exercise, the home environment, and information about daily care for KOA

Research assistants telephoned



Study design

Intervention group

Nine home-based exercises

30–40 min per day at least 3 days per week.

Exercises	Details
Isometric contractions of the quadriceps	1. Sitting or lying down, legs relaxing; 2. Tight the thigh muscles on one side with maximum strength, keep it for 5 s, and relax for 2 s. Repeat 10 times for 1 group and practice 10 groups in succession; 3. Relax this leg and repeat the above action on the other side; 4. Exercise alternately 3 to 5 times with both legs.
Supine straight-leg lifts	1. Lie on the back, stretch knees; 2. One leg is flexed to support the bed surface, the other leg is raised to the heel, about 20 cm away from the bed, held for 5seconds, put down for 5 s, repeat 10 times; 3. Relax this leg and repeat the above action on the other side; 4. Exercise alternately 3 to 5 times with both legs.
Leg lifts in the prone position	1. Lie face down, stretch knees; 2. Lift one leg back to the toe, about 20 cm away from the bed, held for 5 s, put down for 5 s, repeat 10 times; 3. Relax this leg and repeat the above action on the other side; 4. Exercise alternately 3 to 5 times with both legs.
Passive knee flexion	1. Sit on the bed; 2. Hold your hands on one side of the ankle, slowly and forcefully hold the leg to the chest to maximize knee flexion, keep60 s; 3. Relax this leg and repeat the above action on the other side; 4. Exercise alternately 2 to 3 times with both legs.
Passive knee extension	1. Sit on the bed; 2. Put one side of the foot pad 8~10 cm high; 3. Apply light weight to the raised knee joint or apply proper pressure by hand for 60 s; 4. Relax this leg and repeat the above action on the other side; 5. Exercise alternately 2 to 3 times with both legs.
Resistance knee extension	1. Sit on the chair or at the bed, tie a 1 kg sandbag to the ankle, keep the upper body straight; 2. Do not move the thighs, lift your calves until the knees are fully extended, hold for 5 s, rest your legs for 5seconds, repeat 10 times; 3. Relax this leg and repeat the above action on the other side; 4. Exercise alternately 2 to 3 times with both legs.
Resistance knee flexion	1. Standing up, tie a 1 kg weight sandbag to the ankle joint, and support the upper edge of the chair; 2. Stand on one leg and pull the calf back to the other leg, flexing the knee as much as possible while keeping the thigh perpendicular to the ground. Hold for 5 s, put your legs down for 5 s, repeat 10 times 3. Relax this leg and repeat the above action on the other side; 4. Exercise alternately 2 to 3 times with both legs.
Shifting the center of gravity (left and right)	1. Stand up and support a table with a height of 70~80 cm and open the feet; 2. Keep your knees upright, slowly move the center of gravity to the left, and gradually lower your right heel; 3. Keep your knees upright, slowly move the center of gravity to the right, and gradually lower your left heel; 4. Repeat the above action for 3 min.
Shifting the center of gravity (forwards and backwards)	1. Stand up and support a table with a height of 70~80 cm and take one step forward on one side; 2. Keep the knees upright, slowly move the center of gravity forward, and the heel of the hind foot gradually leaves the ground; 3. Keep the knees upright, slowly move the center of gravity backwards, and the forefoot gradually leaves the ground; 4. Repeat the above action for 3 min.

Patients' demographics

Characteristic	Total ($n = 141$)		Intervention ($n = 71$)		Control ($n = 70$)		*P*-value
	N	(%)	*n*	(%)	*n*	(%)	
Age - Mean (SD), y[b]	68.9	(7.35)	68.9	(7.78)	68.8	(6.96)	0.963
Gender[a]							
Male	22	(15.6)	12	(16.9)	10	(14.3)	0.669
Female	119	(84.4)	59	(83.1)	60	(85.7)	
Body mass index - Mean (SD), kg/m^2[b]	25.2	(3.48)	25.0	(3.45)	25.4	(3.51)	0.565
Symptom duration - Mean (SD), y	6.4	(8.52)	6.7	(9.39)	6.0	(7.60)	0.664
Level of education[a]							0.524
Primary school or less	22	(15.6)	12	(16.9)	10	(14.3)	
Junior high school	48	(34.0)	25	(35.2)	23	(32.9)	
High school	31	(22.0)	12	(16.9)	19	(27.1)	
College graduate and above	40	(28.4)	22	(31.0)	18	(25.7)	
Marital status[a]							0.669
Single	22	(15.6)	12	(16.9)	10	(14.3)	
Married	119	(84.4)	59	(83.1)	60	(85.7)	
Number of affected knees [a]							0.207
One	63	(44.7)	28	(39.4)	35	(50.0)	
Two	78	(55.3)	43	(60.6)	35	(50.0)	
Uses a walker[a]							0.637
Yes	5	(3.5)	2	(2.8)	3	(4.3)	
No	136	(96.5)	69	(97.2)	67	(95.7)	
Comorbid conditions[a]							
Hypertension							0.553
Yes	68	(48.2)	36	(50.7)	32	(45.7)	
No	73	(51.8)	35	(49.3)	38	(54.3)	
Diabetes							0.560
Yes	29	(20.6)	16	(22.5)	13	(18.6)	
No	112	(79.4)	55	(77.5)	57	(81.4)	
Coronary heart disease							0.743
Yes	38	(27.0)	20	(28.2)	18	(25.7)	
No	103	(73.0)	51	(71.8)	52	(74.3)	
Osteoporosis							0.105
Yes	21	(14.9)	14	(19.7)	7	(10.0)	
No	120	(85.1)	57	(80.3)	63	(90.0)	
Current drug use							
Analgesics							0.654
Yes	32	(22.7)	15	(21.1)	17	(24.3)	
No	109	(77.3)	56	(78.9)	53	(75.7)	
Cartilage protection drugs							0.067
Yes	29	(20.6)	19	(26.8)	10	(14.3)	
No	112	(79.4)	52	(73.2)	60	(85.7)	

	Intervention ($n = 71$)		Control ($n = 70$)		*P*-value‡	F	*P*-value†	Parameter estimate of GLM	95% CI of parameter estimate of GLM
	Baseline (mean ± SD)	12 weeks (mean ± SD)	Baseline (mean ± SD)	12 weeks (mean ± SD)					
Primary outcome									
WOMAC pain	7.34 ± 3.36	4.28 ± 3.30	7.19 ± 4.48	5.73 ± 3.54	0.683	7.575	0.007*	−1.60	−2.75,-0.58
WOMAC stiffness [a]	2 (0,3)	1 (0,3)	2 (1,4)	2 (1,4)	0.428	7.215	0.008*	−0.79	−1.37, -0.21
Secondary outcomes									
FTSST, s	14.22 ± 3.10	12.13 ± 2.93	14.49 ± 4.10	14.13 ± 4.13	0.669	40.272	<0.001*	−2.82	−3.70, -1.94
TUG, s	13.30 ± 3.14	11.73 ± 1.97	13.02 ± 3.27	12.60 ± 2.81	0.611	21.178	<0.001*	−1.37	− 1.96, -0.78
6MWT, m	408.45 ± 60.54	442.39 ± 49.70	422.86 ± 49.29	417.57 ± 53.04	0.124	12.457	0.001*	29.81	13.11, 46.51
AIMS2-SF total	75.06 ± 10.00	82.00 ± 9.96	76.57 ± 10.62	77.90 ± 9.52	0.433	13.263	<0.001*	5.08	2.32, 7.84
AIMS2-SF-body	27.04 ± 4.50	29.54 ± 3.82	27.94 ± 4.77	28.43 ± 4.29	0.174	8.459	0.004*	1.65	0.53, 2.77
AIMS2-SF-symptoms	10.75 ± 2.41	12.62 ± 1.85	10.89 ± 2.11	11.34 ± 1.78	0.998	11.548	0.001*	1.30	0.54, 2.05
AIMS2-SF- emotional[a]	21 (20, 24)	25 (20, 25)	22 (20, 24)	22 (19.75, 24)	0.486	5.640	0.019*	1.11	0.19, 2.03
AIMS2-SF- society[a]	16 (15, 18)	18 (15. 20)	17 (14, 20)	17 (14.75, 20)	0.316	5.403	0.022*	1.11	0.17, 2.05

Results

	Intervention ($n = 71$)		Control ($n = 70$)		*P*-value‡	F	*P*-value†	Parameter estimate of GLM	95% CI of parameter estimate of GLM
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Results

Measured by:

Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

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Primary outcome									
WOMAC pain	7.34 ± 3.36	4.28 ± 3.30	7.19 ± 4.48	5.73 ± 3.54	0.683	7.575	0.007*	−1.60	−2.75,-0.58
WOMAC stiffness [a]	2 (0,3)	1 (0,3)	2 (1,4)	2 (1,4)	0.428	7.215	0.008*	−0.79	−1.37, -0.21
Secondary outcomes									
FTSST, s	14.22 ± 3.10	12.13 ± 2.93	14.49 ± 4.10	14.13 ± 4.13	0.669	40.272	<0.001*	−2.82	−3.70, -1.94
TUG, s	13.30 ± 3.14	11.73 ± 1.97	13.02 ± 3.27	12.60 ± 2.81	0.611	21.178	<0.001*	−1.37	− 1.96, -0.78
6MWT, m	408.45 ± 60.54	442.39 ± 49.70	422.86 ± 49.29	417.57 ± 53.04	0.124	12.457	0.001*	29.81	13.11, 46.51
AIMS2-SF total	75.06 ± 10.00	82.00 ± 9.96	76.57 ± 10.62	77.90 ± 9.52	0.433	13.263	<0.001*	5.08	2.32, 7.84
AIMS2-SF-body	27.04 ± 4.50	29.54 ± 3.82	27.94 ± 4.77	28.43 ± 4.29	0.174	8.459	0.004*	1.65	0.53, 2.77
AIMS2-SF-symptoms	10.75 ± 2.41	12.62 ± 1.85	10.89 ± 2.11	11.34 ± 1.78	0.998	11.548	0.001*	1.30	0.54, 2.05
AIMS2-SF- emotional[a]	21 (20, 24)	25 (20, 25)	22 (20, 24)	22 (19.75, 24)	0.486	5.640	0.019*	1.11	0.19, 2.03
AIMS2-SF- society[a]	16 (15, 18)	18 (15. 20)	17 (14, 20)	17 (14.75, 20)	0.316	5.403	0.022*	1.11	0.17, 2.05

Results

Muscle strength:

Five-Times-Sit-to-Stand Test (FTSST)

Rise from a chair and return to a seated position as quickly as possible with their arms folded across their chests.

	Intervention ($n = 71$)		Control ($n = 70$)		*P*-value‡	F	*P*-value†	Parameter estimate of GLM	95% CI of parameter estimate of GLM
	Baseline (mean ± SD)	12 weeks (mean ± SD)	Baseline (mean ± SD)	12 weeks (mean ± SD)					
Primary outcome									
WOMAC pain	7.34 ± 3.36	4.28 ± 3.30	7.19 ± 4.48	5.73 ± 3.54	0.683	7.575	0.007*	−1.60	−2.75,-0.58
WOMAC stiffness [a]	2 (0,3)	1 (0,3)	2 (1,4)	2 (1,4)	0.428	7.215	0.008*	−0.79	−1.37, -0.21
Secondary outcomes									
FTSST, s	14.22 ± 3.10	12.13 ± 2.93	14.49 ± 4.10	14.13 ± 4.13	0.669	40.272	<0.001*	−2.82	−3.70, -1.94
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Results

Balance:

Timed Up and Go test (TUG)

Time that takes to get up from a standard height chair, walk 3 m, turn and return to the chair, and sit down again

	Intervention ($n = 71$)		Control ($n = 70$)		*P*-value‡	F	*P*-value†	Parameter estimate of GLM	95% CI of parameter estimate of GLM
	Baseline (mean ± SD)	12 weeks (mean ± SD)	Baseline (mean ± SD)	12 weeks (mean ± SD)					
Primary outcome									
WOMAC pain	7.34 ± 3.36	4.28 ± 3.30	7.19 ± 4.48	5.73 ± 3.54	0.683	7.575	0.007*	−1.60	−2.75,-0.58
WOMAC stiffness [a]	2 (0,3)	1 (0,3)	2 (1,4)	2 (1,4)	0.428	7.215	0.008*	−0.79	−1.37, -0.21
Secondary outcomes									
FTSST, s	14.22 ± 3.10	12.13 ± 2.93	14.49 ± 4.10	14.13 ± 4.13	0.669	40.272	<0.001*	−2.82	−3.70, -1.94
TUG, s	13.30 ± 3.14	11.73 ± 1.97	13.02 ± 3.27	12.60 ± 2.81	0.611	21.178	<0.001*	−1.37	− 1.96, -0.78
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AIMS2-SF-symptoms	10.75 ± 2.41	12.62 ± 1.85	10.89 ± 2.11	11.34 ± 1.78	0.998	11.548	0.001*	1.30	0.54, 2.05
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Results

Walking ability:

Six-Minute Walk Test (6MWT)

This test measures the distance an individual is able to walk in 6min on a 30 m, hard, flat, indoor surface.

	Intervention ($n = 71$)		Control ($n = 70$)		*P*-value‡	F	*P*-value†	Parameter estimate of GLM	95% CI of parameter estimate of GLM
	Baseline (mean ± SD)	12 weeks (mean ± SD)	Baseline (mean ± SD)	12 weeks (mean ± SD)					
Primary outcome									
WOMAC pain	7.34 ± 3.36	4.28 ± 3.30	7.19 ± 4.48	5.73 ± 3.54	0.683	7.575	0.007*	−1.60	−2.75,-0.58
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Secondary outcomes									
FTSST, s	14.22 ± 3.10	12.13 ± 2.93	14.49 ± 4.10	14.13 ± 4.13	0.669	40.272	<0.001*	−2.82	−3.70, -1.94
TUG, s	13.30 ± 3.14	11.73 ± 1.97	13.02 ± 3.27	12.60 ± 2.81	0.611	21.178	<0.001*	−1.37	− 1.96, -0.78
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AIMS2-SF total	75.06 ± 10.00	82.00 ± 9.96	76.57 ± 10.62	77.90 ± 9.52	0.433	13.263	<0.001*	5.08	2.32, 7.84
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Results

Quality of life:

Arthritis Impact Measurement Scales 2 - Short Form (AIMS2-SF)

A self-assessment scale specifically for arthritis patients

Conclusion

Home-based exercise intervention reduced pain intensity and joint stiffness, increased the muscle strength of the lower limbs, balance, and mobility, and improved the quality of life of elderly patients with Knee OA living in the community.

The program is inexpensive, easy to use, safe, and suitable for being practiced at home.

Άθληση και Οστεοαρθρίτιδα

Βιβλιογραφική ενημέρωση

Ευχαριστώ πολύ!

για την προσοχή σας