

The effective interventions to improve long-term physiotherapy exercise adherence among patients with lower limb osteoarthritis. A systematic review

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Abstract

Introduction: Osteoarthritis (OA) is a chronic condition that severely effects work life balance impacting psychosocial and socio-economic aspects. Physiotherapy exercise is one of the intervention methods for the management of OA. Adherence to the exercise by patients is essential for the effective management of OA.

Objectives: To determine different methods used to enhance physiotherapy exercise adherence for more than 12 months among patients with osteoarthritis and to report the effective method to enhance exercise adherence among people with lower limb osteoarthritis.

Design: Systematic review

Methods: PubMed, Pedro, Web of Science, and EMBASE databases searched for randomized controlled trials, cohort studies, case-control studies, and cross-sectional studies published in the English language from 2000 to 2020. The date of data extraction was 04 September 2020. Two independent researchers conducted literature search, assessed eligibility, extracted data, conducted methodology quality assessment using the PEDro scale, and conducted risk of bias assessment. A narrative synthesis of key outcomes is presented; preferred Reporting Items for Systematic review was used to report the review. The study protocol was registered in the Prospero (Prospero ID: CRD42020205653).

Results:

The primary search strategy identified 5839 potentially relevant articles, of which 5157 remained after discarding duplicates. After screening based on title and abstract, 40 papers were potentially eligible for inclusion. Five of these papers met all predefined eligibility criteria. Introducing methods to enhance exercise adherence has caused a significant increase in exercise adherence for the short term (less than six months or 12 months). There were no significant differences, long-term adherence with different methods, reported. The results indicate that booster sessions (89.69%) and telephone-linked communication (86%) had higher percentages for the exercise adherence. Secondary outcomes such as pain, stiffness, function, show positive outcomes with increasing exercise adherence. However, there were no significant differences reported.

Conclusion:

The booster sessions and telephone-linked communication appear to enhance exercise adherence for more than 12 months among patients with osteoarthritis. However, a number of high-quality studies are inadequate to confirm our findings. Therefore, more studies with higher methodological quality are needed to determine the best strategies to enhance long-term exercise adherence among people with osteoarthritis.

Key terms: Osteoarthritis, Long term, Exercise adherence

Background

Osteoarthritis (OA) is defined as a "clinical syndrome of joint pain accompanied by varying degrees of functional limitation and reduced quality of Life" (1). This is characterized by "pathologically loss of cartilage, remodeling of adjacent bone and associated inflammation" (1). OA can develop as primary

osteoarthritis and secondary osteoarthritis where there is predisposing conditions exist. This is one of the important causes of disability and pain (2). OA has an impact on individuals, society, and the health care system. In terms of individuals, it affects a person's quality of life by causing pain and reduction in function. OA can affect joints in peripheral either single or multiple joints. Small hand joints, hips, and knees are commonly affected joints (1).

OA is managed through non-pharmacological and pharmacological methods. Guidelines have been developed to manage OA. There are many guidelines for the management of OA, such as the NICE (National Institute for Clinical Excellence) guideline, OARSI (Osteoarthritis Research Society International), and EULAR (European League Against Rheumatism). According to the NICE guideline, education, advice, information access, exercises for strengthening, aerobic fitness, and weight loss should be considered as core treatments (1). Paracetamol and topical NSAIDs should be considered when further treatment is needed (1). Other options include self-management techniques (Local heat and cold, assistive devices), pharmaceutical options and surgery (joint arthroplasty), and non-pharmaceutical treatments (support and braces, shock-absorbing shoes or insoles, TENS, and manual therapy), which are less well proven for efficacy, less symptom relief and risk for patients (1).

The WHO defines "The extent to which a person's behavior corresponds with agreed recommendations from a healthcare provider" as adherence (3). Adherence to these guidelines by health care providers and patients is an important factor for the effective management of OA. In patients with osteoarthritis, a low level of adherence to physiotherapy exercise affects the effectiveness and outcomes of prescribed exercise (4) (5) (6). It is important to study effective methods to enhance adherence to core management methods, especially long-term adherence to exercises by OA patient groups.

One of the significant challenges in chronic and long-term conditions is adherence to the exercises or management guidelines. Supervised exercise sessions, refresher sessions, audio or videotapes of exercise programme, self-management programme, and cognitive adherence measures are identified methods to improve exercise adherence. The study findings concluded that supervised and individual exercise therapy and self-management techniques increase exercise adherence among adults with chronic musculoskeletal pain (7). A Cochrane review suggested self-management techniques, supervised, and individualized exercise programme, activity monitoring, feedback systems, written instructions and behavioral exercise programme, booster sessions, behavioral graded exercises, and peer-delivered programme have shown adherence potential (3). A study conducted in Australia to identify the barriers and enablers for the management of osteoarthritis stated that ongoing episodic nature, the availability of visual evidence of joint surface damage on X-ray images, prescribing exercise when it is perceived as a reason for joint surface damage are the challenges in the management of OA. This study suggested that adherence to the guideline by clinicians can be enhanced by decision support and reminder system, interactive educational strategies and educational outreach, clinical practice audits with feedback to clinicians (8).

Osteoarthritis is a chronic condition. Therefore, it is essential to study adherence to core management methods, especially adherence to physiotherapy exercise by patients with osteoarthritis, identify the methods to enhance the adherence to these guidelines, long term, more than 12 months, follows up to monitor or evaluate the adherence to guidelines and investigate the effectiveness of the intervention methods to

enhance the exercise adherence among patients with osteoarthritis. This study was aimed to determine the methods to enhance long term, more than 12 months, exercise adherence among patients with lower limb osteoarthritis and to identify the effective method to enhance the exercise adherence by patients with osteoarthritis.

Methodology

A systematic review was performed to identify effective methods to enhance long-term (> 12 months) exercise adherence among patients with lower limb osteoarthritis. This systematic review was conducted according to the Preferred Reporting Items of Systematic Reviews and Meta-Analyses (PRISMA) guidelines (9). This protocol was registered (protocol was not peer reviewed, registration during the 2020 pandemic was automatically published exactly as submitted) in the Prospero (Prospero ID: CRD42020205653).

Search strategy

A literature search was performed using electronic databases (PubMed, Pedro, EMBASE, and Web of Science). Databases were searched for randomized controlled trials, cohort studies, case-control studies, and cross-sectional studies published in English from 2000 to 2020. The search strategy included only terms relating to or describing the interventional methods. The keywords used for the search were osteoarthritis, arthritis, hip, lower limb, knee, extended period, long period, compliance, adherence, follow-up, engagement, strengthening, exercise, Physical therapy, rehabilitation therapy, resistance training, muscle strengthening, and aerobic exercise. Full search strategy and individual results can be found in electronics supplement. The searches were re-run just before the final analyses and further studies were retrieved for inclusion. The date of data extraction was 04 September 2020. Cited articles among included studies also checked

Selection criteria

Full papers were included in the final analysis. Randomized controlled trials (RCTs), cohort studies, case-control studies, and cross-sectional studies published in English and peer-reviewed journals were eligible for inclusion.

Studies conducted among the population with lower limb knee or hip joint osteoarthritis, recruited -both males and females age above 18-year and carried out physiotherapy exercise as a primary intervention and followed up for more than 12 months were eligible for inclusion.

Outcome

Articles were included if the intervention(s) aiming to improve adherence, compliance, or engagement with exercise, compared with either no adherence or engagement intervention. A paper with a comparator group that was also undertaking the exercise programme and where a no-intervention control group occurred for a long duration, but at least two active intervention groups to offer a comparison also included.

Studies were excluded due to many reasons, and the most common reason was the follow-up duration. Most of the trials were not followed up for more than 12 months. Studies were excluded when physiotherapy

exercise was not the intervention for patients with osteoarthritis or no intervention to improve exercise adherence.

Data extraction

Two independent researchers retrieved titles and abstracts of studies using the search strategy and those from additional sources were screened independently by two reviewers (CP & NK). The full text of these potentially eligible studies was retrieved and independently assessed for eligibility. Disagreements were resolved through discussion with a third reviewer (GS).

A predetermined extraction form was used to extract data from the included studies to assess study quality and evidence synthesis. Study setting, study population, and participant demographics, details of the intervention, methods used to enhance exercise adherence, study methodology were extracted independently by two review authors, discrepancies identified and discussed to resolve, and a third reviewer's opinion was taken when it is not possible to resolve. Relevant authors were requested for missing data. The investigators were contacted to get missing data.

Quality and Risk of Bias assessment

Two reviewers independently conducted methodology quality assessment using the Pedro scale, and the Risk of Bias Assessment tool was used to assess the risk of bias (Table 1). The PEDro scale is composed of 11 items, of which the first item is only applicable for specification of eligibility criteria, and it was not considered as part of calculating the overall PEDro score. Each item was given one point, and the total score could be between 0 to 10 points. Studies that scored ≥ 4 points were considered as "high" quality and studies scored < 4 points were considered as "low" methodological quality (10). Studies heterogeneity checked for potential meta-analysis

Table 1

The table shows risk of bias assessment using Risk of Bias Assessment tool for systematic reviews tool

Risk of Bias assessment criteria	Pisters et al 2010	Brosseau et al 2012	Hughes 2010	Bennell et al 2017	Baker et al 2020
Risk of bias arising from the randomization process	⊇	⊇	⊇	⊇	⊇
Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	⊇	⊇	-	⊇	⊇
Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	?	⊇	?	?	?
Missing outcome data	⊇	-	⊇	⊇	⊇
Risk of bias in measurement of the outcome	⊇	⊇	-	⊇	⊇
Risk of bias in selection of the reported result	⊇	⊇	⊇	?	?
Overall risk of bias	⊇	⊇	?	?	?
Low risk of bias (green), high risk of bias (red), unclear risk of bias (amber)					

Results

Selection of studies

The primary search strategy identified 5839 potentially relevant articles of which 5157 remained after discarding duplicates (Fig. 1). The date of data extraction was 04 September 2020. After screening based on title and abstract, 40 papers were potentially eligible for inclusion. Number of additional articles from external search was zero. 5 of these papers met all predefined eligibility criteria.

Characteristics of included studies

In total, 1113 patients with lower limb osteoarthritis were included in the five studies that were analyzed. All studies used an RCT design. All studies included patients who were currently diagnosed with knee osteoarthritis or hip osteoarthritis or both. The median sample size was 223 participants (range 104 to 419). The mean age was 65.37 (\pm 3.42) years. The mean length of the follow-up was 26.6 months (range 18 to 55 months). Of the five studies, four reported using the intention-to-treat (ITT) method for missing data, and one study did not confirm the type of analysis used. In selected five studies booster sessions, behavioral approach, telephone sessions, and motivation calls and telephone reinforcement were used to enhance exercise adherence.

In 5 studies, mean duration of exercise interventions was 19.6 weeks (range 6 to 48 weeks). Interventions include individually-tailored exercises with complete protocol include written materials such as education messages, activity diaries, performance charts (6), walking sessions (11), 60 minutes of stretching/flexibility, low-impact aerobics, strengthening and balance exercise followed by 30 minutes of manual-based, group problem-solving/ health education for managing OA with PA (12), 30 minutes consultations with a

physiotherapist over six months for education, home exercise, and physical activity advice(13) and six weeks group exercise classes (14).

In 5 studies, behavioral approach at a community-based walking club (11), telephone sessions with a health coach (13), TLC motivational calls (14), telephone reinforcement (12) and booster sessions (6) were the strategies used to enhance the exercise adherence among participants in the experimental groups.

In addition to exercise adherence, physical activity level, lower extremity pain, stiffness, function, sit-stand, 6 minutes distance walk, anxiety, or depression, the Western Ontario and McMaster Universities Arthritis Index (WOMAC) pain, WOMAC physical activity, function subscale, functional performance assessment, quadriceps and hamstring strength were other outcomes measured in these studies.

Assessment of methodological quality and quantitative analysis.

The five included studies were scored using the PEDro scale. Methodological quality ranged from 3 to 8 as rated on the PEDro scale with a median score of 6.8. The methodology quality assessment is summarized (see Table 2).

Cohen's Kappa analysis was performed to identify the agreement between raters on methodology quality of the included studies. The percentage of agreement on methodological quality was noted as 80%. Moderate interrater reliability with $k = 0.72$, $SE = 0.21$ (15), analyzed using SPSS (Statistics version 26.0.0; SPSS Inc., Chicago, IL).

All studies were rated as high qualitative studies with a score of ≥ 4 (10), of which 2 scored 8 of 10 points, of which 2 scored 7 of 10 points. Quantitative analysis by pooling outcome data (meta-analysis) or a best-evidence synthesis was inappropriate. This is due to the incomparability of outcome data caused by the heterogeneity of techniques to enhance exercise adherence. Table 3 summarizes the characteristics of the studies included in the analysis.

Measurement instruments and outcome measures of adherence

Adherence to exercise intervention was measured using a questionnaire (6), the number of attended walking sessions divided by the number of prescribed sessions recorded by the exercise therapist and participants' completed logbooks (11), self-report questionnaires completed at home at baseline, 6, 12 and 18 months (13), single self-report item interviewer-administered at 12 and 24 months and administered by phone at 18 months (14), self-administrated questionnaire (16).

Table 2

Table shows methodological quality assessment of included studies assessed using Pedro scale

Methodology quality assessment	Pisters et al 2010	Brosseau et al 2012	Hughes et al 2010	Bennell et al 2017	Baker et al 2020
Eligibility criteria were specified (Not used in score generation)	Y	Y	Y	Y	Y
Subjects were randomly allocated to groups	Y	Y	Y	Y	Y
Allocation was concealed	Y	Y	NG	Y	Y
Groups were similar at baseline	Y	Y	Y	Y	NG
Subjects were blinded	Y	N	N	Y	NG
Therapist who administered the treatment were blinded	N	N	N	N	N
Assessors were blinded	Y	Y	N	Y	Y
Measures of key outcomes were obtained from more than 85% of subjects	N	N	N	N	Y
Data were analysed by intention to treat	Y	Y	NG	Y	Y
Statistical comparisons between groups were conducted	Y	Y	Y	Y	Y
Points measures and measures of variability were provided	Y	Y	NG	Y	Y
Total score	8	7	3	8	7
Y: Yes, N: No, NG: Not given					

Discussion

This review summarizes different methods to enhance exercise adherence among people with knee osteoarthritis for more than 12 months. Different factors were reported for loss of follow-up with the exercise programme. This section will focus on the main findings related to the study.

Summary of main findings

Five studies were eligible according to the inclusion criteria. Strategies used to enhance exercise adherence varies among trials. Booster sessions, behavioral approaches, telephone sessions, Telephone Linked Communication, motivational calls, and telephone reinforcement have been used as strategies in these studies.

The long-term exercise adherence rate of the following methods varied between studies. 89.69% was the adherence rate for the five-booster session group, 59.4 % was the adherence rate for the behavioral approach

group, 39% adherence rate for 6 to 12 telephone sessions with a health coach, 86% was the adherence rate for the Telephone linked communication group. The individual score is not available for the telephone reinforcement group. According to the results, booster sessions and telephone-linked communication had higher percentages for exercise adherence. Therefore, future study should investigate effectiveness of these two strategies in enhancing exercise adherence.

According to the systematic review results, introducing methods to enhance exercise adherence has only a short-term impact. There are no significant differences in long-term adherence with different methods. Further, most of the secondary outcomes show positive outcomes with increasing exercise adherence. However, there are no significant differences in outcomes between experimental and control groups. The reasons for the non-significant difference might be due to a lack of adherence to the exercise guidelines. It is recommended that an individual patient should be assessed and the potential reasons for lack of adherence in future, for example lack of motivation, socioeconomic situation, family and work commitments, should be assessed when formulating exercise adherence strategies for an individual. This might potentially enhance their exercise adherence.

Outcome measures were used to measure exercise adherence in the selected studies. Those are participants' self-rated adherence questionnaire, pedometer to monitor Physical activity, a logbook to record activity level and validated questionnaires, self-report community healthy activities model for older adults, self-report questionnaire and single self-report item. Self-rated adherence rate might have a bias as it depends on the participant's response. Therefore, a standard method, such as attendance records and validated wearable activity trackers, should be used in future studies to report exercise adherence rates (10).

Commonly reported reasons for loss of follow up were co-morbidity, selected surgical intervention option, family circumstances, decline to participate, lack of motivation, increase pain, loss of contact, withdrawal from the study due to personal reasons, other illness, family illness, lack of time, change in the location and death. It is reported that the barriers to continuing with the interventions were weather conditions and health problems of participants' partners. A study was conducted to determine the predictors of adherence to exercise interventions during and after cancer treatment. According to the results, prominent predictors of exercise adherence were the location of the rehabilitation center, motivation for exercise (10). These factors are similar to people with osteoarthritis. Therefore, it is important to consider these barriers and reasons when identifying an interventions to enhance the exercise adherence among people with long term conditions.

Strengths

One of the strengths of this systematic review is that four studies were of "high" methodological quality. This systematic review used the PRISMA guidelines for reporting systematic review and used the PEDro scale.

Limitations

Several limitations should be considered during this study's interpretation and should be addressed in future research. Only five studies assessed exercise adherence for more than 12 months, were included in this systematic review. Different exercise interventions and exercise adherence strategies were used in these five

studies; it is varied in duration, intensity. The heterogeneity is noted in these studies. Therefore, a quantitative analysis by pooling outcome data (meta-analysis) or a best evidence synthesis was inappropriate. The Interrater reliability is noted as 0.72 because of a few number of studies (5 studies) included in this study.

It is noted in the existing literature, only a limited number of studies focused on exercise adherence for more than 12 months. Also, self-reported exercise adherence was used to assess the adherence rate. Exercise should be followed as one of their routine activities among people with chronic conditions, osteoarthritis. Many studies reported exercise adherence for less than 12 months period or until patients actively participate in the clinical visits. However, it should be followed for a longer duration to ensure that patients achieve the benefits of the prescribed exercise programme. These limitations should be addressed in future studies.

Future research

Only five studies were eligible according to the criteria. Therefore, in the future, more studies should be conducted to identify the best strategies to maintain exercise adherence for more than 12 months among people with osteoarthritis. Also, attendance records and validated wearable activity trackers should be used to calculate exercise adherence among participants.

Table 3
Table shows the data extraction of included five studies

	Pisters et al 2010	Brosseau et al 2012	Bennell et al 2017	Baker et al 2020	Hughes et al 2010
Design	Single-blind cluster-randomised trial	Single-blind, randomised control trial	Randomised control trial	Single-Blind, parallel-arm randomised controlled trial	Randomised control trial
Sample size	200 (Exp (n) = 97, Con (n) = 103)	222 [W = 79, WB = 69, Con = 74]	168	104 [Con = 44, TLC = 45]	419 [Negotiated TR = 103, Negotiated No TR = 98, mainstream Tel = 105, Main No Tel = 113]
Duration-Follow up (months)	up to 55	18 (12 intervention, 6 month follow up)	18	24	18
Population([N], Gender, Age, Joint involved)	Exp [Age = 65(7), Gender (males) = 24(25)], Con [Age = 65(8), Gender (males) = 22(21)]	Age [w = 63.9(10.3), WB = 63.9 (8.2), Self-directed control = 62.3(8.6)], Men/Women, (%) [w = 24(30.4)/55(69.9), 18(26.1)/51(73.9), 69(31.1)/153(68.9)]	Age [PT + Coaching = 61.1 ± 6.9, PT = 63.4 ± 7.8], Male, n (%) = [PT + Coaching = 27(32), PT = 35(42)]	Age [TLC = 65.8 ± 6.6, Con = 64.5 ± 8.3], female n (%) [TLC = 42 (80.8), Con = 43(82.7)]	Majority female, Age 71.1
Exercise intervention (Type, frequency, duration, intensity)	Maximum if 18 sessions over a 12-week period. The complete protocol included written materials such as education messages, activity diaries, performance charts.	Walking programme (supervised walking programme or unsupervised/self-directed walking programme)	5* Individual Physiotherapy sessions	6-Week group exercise class and monthly Automated Phone messages to strength Train and Complete Exercise Logs	Fit and strong programme
Adherence facilitation	Five booster sessions in week 18,25,34,42 and 55.	Behavioural approach at the community-based walking club	6 to 12 telephone sessions with a health coach	TLC motivational calls and	Telephone reinforcement

	Pisters et al 2010	Brosseau et al 2012	Bennell et al 2017	Baker et al 2020	Hughes et al 2010
Outcome measure(s)	Participants self-rated adherence, SQUASH	Validated questionnaire, Physical tests	Self-report questionnaire, 11-point NRS, WOMAC, NRS pain on walking, WOMAC pain scale, Assessment of QoL, Physical activity for the elderly (PASE), AAS, Accelerometer-based device	Single self-report item, WOMAC pain, Physical function subscales, Biodex System 3	Physical activity Maintenance, WOMAC, functional lower extremity strength (timed-stand), functional exercise capacity (6-minute distance walk), Body Mass Index, Depression
Lost to follow up	21 (Exp (n) = 10, Con (n) = 11), 20% loss to follow up	18 months [W = 44.3%, WB = 40.6%, Con = 52.1%]	Loss to follow up 26 of 168 (15%), 32 of 168 (19%) and 40 of 168 (24%)	out of 52, [TLC = 7/52, Con = 8/52]	91 unable to locate, 29 unable to schedule, and 40 refused
Adherence rate	-	-	PT + Coaching 3.8 [95% CI- 3.1, 4.6] versus PT 3.6 [95% CI 2.9, 4.4], mean difference 0.2 [95% CI -0.8, 1.2]	[Mean control group = 4.01 [95% CI 3.03,4.99, Mean for TLC 3.63 [95% CI 2.70, 4.56]; P = 0.57)	74% the participants completed measurement at 12 months, 62% (259) at 18 months
Long term outcome	Significant difference is present. Higher in experimental group	There is difference. But significant level is not mentioned	No significant difference between groups	No significant difference between groups	TR positively affect perceptions around engagement

Exp: Experimental group, Con: Control group, W: Walking, WB: Walking and Behaviour, TLC: telephone-linked communication, TR: Telephone reinforcement, Tel: telephone, QoL: Quality of Life

Conclusion

According to the results, booster sessions and telephone-linked communication had higher percentages for exercise adherence. Results indicated that utilizing different strategies has non-significant influence on the exercise adherence for more than 12 months period and non-significant difference in the primary and secondary outcomes. However, number of high-quality studies are inadequate to confirm our findings.

Therefore, high quality future studies are need to determine a best strategy to enhance exercise adherence for long term among patients with osteoarthritis.

Abbreviations

OA: Osteoarthritis

NICE: National Institute for Clinical Excellence

OARSI: Osteoarthritis Research Society International

EULAR: European League Against Rheumatism

WHO: World Health Organization

PRISMA: Preferred Reporting Items of Systematic Reviews and Meta-Analyses

ITT: Intention-To-Treat

TLC: Telephone linked Communication

WOMAC: Western Ontario and McMaster Universities Arthritis Index

Exp: Experimental group

Con: Control group

W: Walking

WB: Walking and Behaviour

TR: Telephone reinforcement

Tel: Telephone

QoL: Quality of Life

Declarations

Ethics approval and consent to participate: It was not taken as in this study no participants were recruited. Consent was not taken as in this study no participants were recruited.

Consent for publication: Not applicable.

Availability of data and material: Supplementary file is attached with search strategies. The datasets used and/or analyzed during the current study are available from the corresponding author [CP] on reasonable request.

Competing Interests: Authors declare no competing interests.

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Author contributions: Conception and design of the study: CP, GS, Screening of the articles: CP, NK and GS; Data extraction: CP and NK; Methodological quality ratings and data analysis: CP and NK; First drafting of the manuscript: CP and NK; Reviewing article: GS, CP and NK; Editing: CP and NK. All authors approved the version to be published.

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Figures

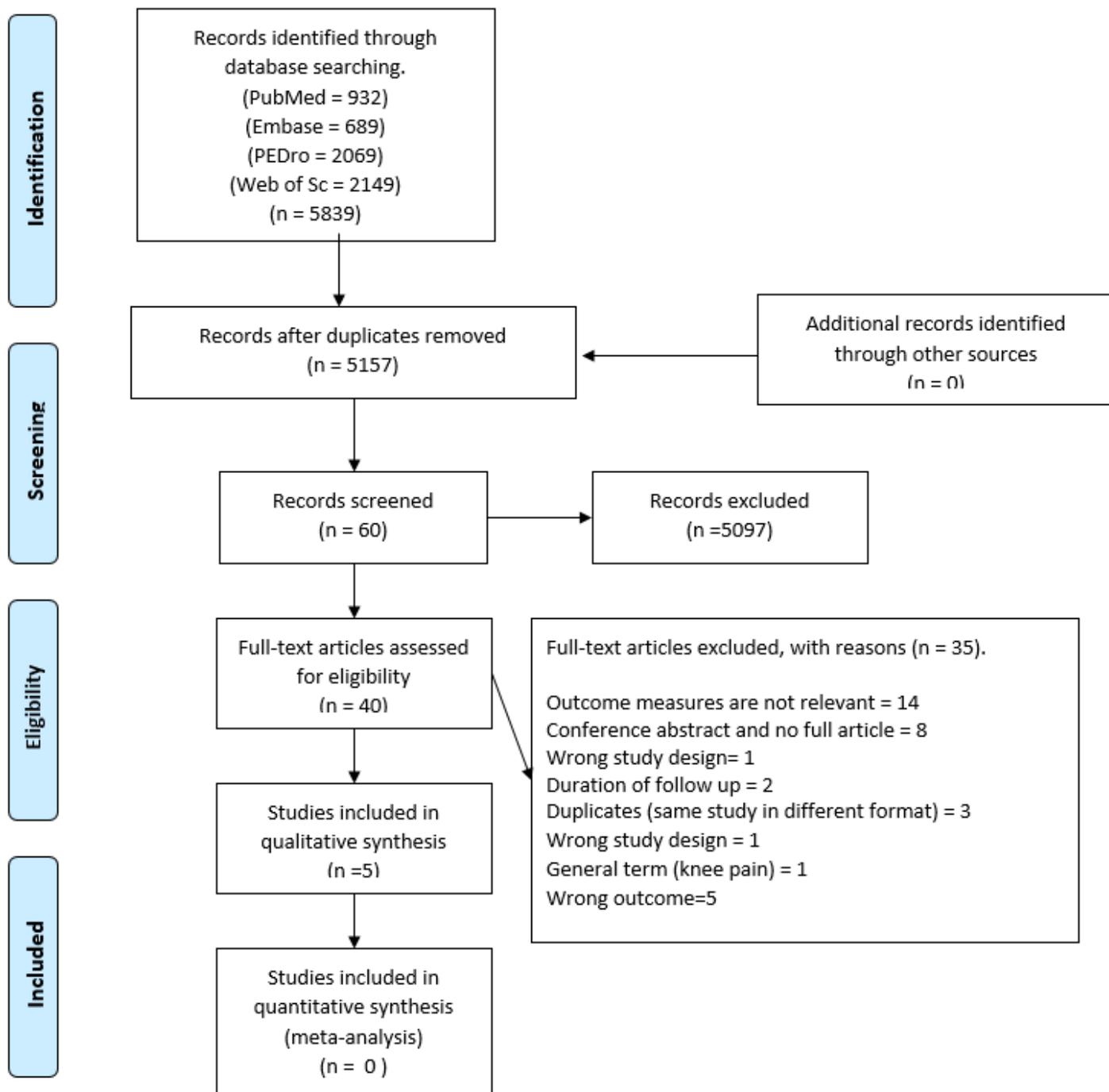


Figure 1

PRISMA Flow chart

Supplementary Files

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- [3.PRISMAchecklist22092021.docx](#)

