Statistical Analysis Plan

Patient e-learning to enhance exercise outcomes in people with knee osteoarthritis: a randomised controlled trial

Public Title: The PEEKO study – Patient education to enhance exercise outcomes in people with knee osteoarthritis: a randomised controlled trial

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SAP Signatures

I give my approval for the attached SAP entitled PEEKO SAP dated 16th February 2026.

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ABBREVIATION	DEFINITION
ACTRN	Australian New Zealand Clinical Trials Registry Number
ASES	Arthritis Self-Efficacy Scale (pain subscale)
ASGC	Australian Standard Geographical Classification
BFMS	Brief Fear of Movement Scale for Osteoarthritis
B-IPQ	Brief Illness Perceptions Questionnaire
BMI	Body mass index
CHESM	Centre for Health, Exercise and Sports Medicine
CI	Confidence interval
CONSORT	Consolidated Standards of Reporting Trials
cLDA	Constrained longitudinal data analysis
DSMB	Data Safety Monitoring Board
EARS	Exercise Adherence Rating Scale
E-learning	Electronic learning
GP	General practitioner
ICH	International Council for Harmonisation
IQR	Interquartile range
IV	Instrumental variable
KOOS	Knee Injury and Osteoarthritis Outcome Score
MAR	Missing at random
MCAR	Missing completely at random
MCID	Minimum clinically important difference
MISCH	Methods and Implementation Support for Clinical and Health research
MNAR	Missing not at random
NRS	Numerical Rating Scale
OAKS	Osteoarthritis Knowledge Scale
OA	Osteoarthritis
OR	Odds ratio
PASE	Physical Activity Scale for the Elderly
PEEKO	Patient E-learning to enhance Exercise outcomes in people with Knee Osteoarthritis
REDCap	Research Electronic Data Capture
RCT	Randomised controlled trial
RR / RRR	Relative risk / Relative risk ratio
SAP	Statistical analysis plan
SD	Standard deviation
SEE	Self-Efficacy for Exercise scale
SOP	Standard Operating Procedure
WOMAC	Western Ontario and McMaster Universities Osteoarthritis Index

Introduction

1.1 Preface

Osteoarthritis (OA) is a chronic joint condition that typically involves the knee. It affects around 20% of Australians over the age of 45[1] and has a significant impact on those affected, causing joint pain, impaired function and reduced quality of life. In the absence of a known cure, the aim of treatment is to alleviate joint symptoms and prevent negative quality of life impacts with condition-specific education, exercise and weight management (if indicated) recommended for all people with OA.[2]

Despite the universal recommendation that all people with OA participate in exercise-based treatment, regardless of symptom severity, evidence has shown it has only modest effects on joint pain and physical function.[3] Numerous studies have shown that people with OA commonly hold misconceptions about the nature of their condition, its trajectory, and the influence of exercise on their joint health which can erode their confidence in the safety and efficacy of exercise as a treatment.[4,5] Such negative exercise beliefs may lead to poor exercise uptake, reduced exercise adherence and low outcome expectations of exercise as a treatment[4-6] - all of which may reduce the ability of exercise treatment to positively impact clinical outcomes. This creates a challenge for physiotherapists, who are the primary prescribers of exercise treatment for knee OA, in supporting their patients to start and adhere to recommended exercise treatment. In addition, many people with OA face challenges accessing physiotherapy including high cost and a lack of availability.[7] Hence, investigating novel approaches that enhance exercise outcomes from minimal clinician contact are warranted.

Furthermore, a recent systematic review[8] of consumer education for people with knee OA, which included 29 trials, showed that combining education with exercise treatment produced superior and clinically meaningful improvements in function compared to education alone. Although this was based on low quality of evidence, it supports the view that education should not be used as a stand-alone treatment, but rather in conjunction with recommended treatments like therapeutic exercise. The more clinically relevant question of whether the addition of education to exercise treatment results in superior clinical outcomes remains unanswered.

Clinicians report challenges providing detailed and accurate patient education to support their exercise prescription and facilitate patient self-management including a lack of time, confidence and expertise.[9] Indeed, a recent report by consumer advocacy group, Musculoskeletal Australia, found that people with OA are dissatisfied with the quality and amount of information currently provided to them.[10] To improve patient access to high-quality education information about OA and its recommended management, we developed a patient-focused e-learning course, informed by educational theory and evidence-based OA recommendations.[11] The course has been made freely available worldwide via the online education platform, FutureLearn and has over 1,000 people enrolled (see: https://go.unimelb.edu.au/6ume). In a randomised controlled trial of 120 people, the course was found to improve osteoarthritis knowledge in people with hip and/or knee OA, when compared to a typical OA education intervention: an electronic OA information pamphlet available from a reputable consumer organisation (manuscript under review). Building on this work, we now seek to explore whether the course can enhance clinical outcomes from home-based exercise that is prescribed by physiotherapists in a limited number of consultations.

1.2 Purpose of the analyses

The purpose of this Statistical Analysis Plan (SAP) is to outline the pre-planned analyses to be completed to support the main publication of the PEEKO study.

2 Study Objectives and Endpoints

2.1 Study Objectives

Primary:

To investigate if the addition of the e-learning course to verbal OA information and a home-based strengthening exercise program prescribed over 2 consultations with a physiotherapist enhances pain and/or physical function outcomes, at 24 weeks in people with knee OA.

Secondary:

i) To determine if the e-learning course confers additional benefits for other clinical outcomes (knee-related quality-of-life; sport and recreation; self-efficacy for exercise; pain self-efficacy; physical activity levels; OA knowledge; perceptions of OA (illness perceptions); fear of movement; belief in inevitability of needing a knee joint replacement; global rating of change; satisfaction with treatment; exercise adherence; and use of recommended OA self-management approaches (including uptake of physical activity and weight loss efforts) and oral pain medication), at 24 weeks.
ii) To compare the proportion of participants achieving minimum clinically important differences in the primary outcomes between the two treatment groups.
iii) To explore potential moderators (baseline participant characteristics) of treatment effect on the primary outcomes, based on the following *a priori* hypotheses (based on theoretical rationale) including:
    a. OA knowledge (Osteoarthritis Knowledge Scale (OAKS)[12]): those with lower knowledge at baseline will have greater improvements in pain and function with the e-learning course compared to no e-learning course.
    b. self-efficacy (Arthritis Self-Efficacy Scale[13]): those with lower pain self-efficacy at baseline will have greater improvements in pain and function with the e-learning course compared to no e-learning course.
    c. fear of movement (Brief Fear of Movement Scale for Osteoarthritis[14]): those with higher fear of movement at baseline will have greater improvements in pain and function with the e-learning course compared to no e-learning course.
    d. Brief Illness Perceptions Questionnaire (B-IPQ)[15]: those with a more threatening view of OA and its prognosis at baseline will have greater improvements in pain and function with the e-learning course compared to no e-learning course

This study will also describe engagement with, and perceived usefulness of, each course module.

2.2 Endpoints

The two self-reported primary outcomes are psychometrically acceptable, reliable and valid measures recommended for use in clinical trials of knee OA[16]. Both will be collected at baseline and 24-weeks (primary time point).

Average knee pain during walking in the last week (also referred to as 'self-reported severity of knee pain during walking over the past week' in the trial registration) will be measured using an 11-point Numerical Rating Scale (NRS) ranging from 0 to 10 (where 0=no pain; 10=worst pain possible)[17] .

Physical function will be measured using the physical function subscale of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) with responses from 0 to 68, where higher scores indicate greater dysfunction[18].

A range of self-reported secondary outcomes will be measured at baseline and 24-weeks, unless indicated otherwise:

i) Sport and recreation subscale of the Knee Injury and Osteoarthritis Outcome Score (KOOS) with 5 items. Scores range from 0 to 100 (lower indicating worse function).[19]

ii) Knee-related quality of life subscale of the KOOS with 4 items. Scores range from 0 to 100 (lower indicating worse quality of life).[19]

iii) The Pain subscale of the Arthritis Self-Efficacy Scale (ASES pain) with 5 items. Scores range from 1 to 10 (higher indicating greater pain self-efficacy)[13].

iv) Self-efficacy for Exercise (SEE) Scale with 9 items. Scores range from 0-90 (higher indicating higher self-efficacy for exercise)[20].

v) Brief Fear of Movement Scale for OA with 6 items. Scores range from 6 to 24 (higher indicating greater fear)[14].

vi) Physical Activity scale for the Elderly (PASE) with 10 items. Scores range from 0 to 1177 (higher indicating greater levels of physical activity)[21].

vii) Osteoarthritis Knowledge Scale (OAKS) with 11 items. Scores range from 11 to 55 (higher indicating more accurate knowledge about OA)[22].

viii) Brief Illness Perceptions Questionnaire (B-IPQ) with 8 items[15]. Scores range from 0-80 (higher indicating a more threatening view of OA).

ix) Belief in the inevitability of needing knee joint replacement surgery measured with a study specific item. Participants will be asked their level of agreement with the statement 'I believe that I will need a knee joint replacement at some point' (response options true, unsure, false will be dichotomised into 'true' versus 'false or unsure').

x) Global rating of change in the knee overall compared to baseline scored on a 7-point Likert scale from "much better" to "much worse" (24-weeks only). Participants indicating they are "moderately better" or "much better" will be classified as 'improved'.

xi) Satisfaction with treatment scored on a 7-point Likert scale from "extremely unsatisfied" to "extremely satisfied" (24-weeks only). Participants indicating they are "moderately satisfied" or "extremely satisfied" will be classified as 'satisfied'.

xii) Exercise Adherence Rating Scale Section B [23] with 6 items (24-weeks only). Scores range from 0 to 24 (higher indicating better adherence).

xiii) Number of days strengthening exercises were performed in the previous fortnight (24-weeks only). Scores range from "0 days" to "14 days". The outcome will be dichotomised into 'less than 6 days' versus '6 to 14 days'.

xiv) Uptake of physical activity, in addition to physiotherapist prescribed exercise, since baseline with a study specific item: "Apart from the exercises provided by my physiotherapist for this study, in the last 24 WEEKS my physical activity levels have…" with response options on a 5-point Likert scale from "decreased significantly" to "increased significantly" (24-weeks only). Participants indicating they have "increased slightly" or "increased significantly" will be classified as 'increased'.

xv) Weight loss efforts since baseline (24-weeks only): "Over the past 24 WEEKS have you made any efforts to lose weight or manage your weight? (for example, changed your diet)" with 4 response options ranging from "I have not thought about making efforts to lose weight/manage my weight" to "I have made a lot of effort to lose weight/manage my weight". The number and proportion of each response option will be reported.

xvi) Self-reported use of oral pain medications for knee pain (24-weeks only). Number and proportion of participants using common oral pain-relieving medications for knee pain at least once a week in the prior month will be reported.

3 Study Methods

3.1 General Study Design and Plan

This project is a two-arm parallel randomised controlled superiority trial. Recruitment occurred across all Australian states/territories. Eligible participants are those who meet the National Institute for Health and Care Excellence clinical criteria for OA, have experienced at least 3 months of knee pain, experience knee pain on most days, and report pain on walking ≥ 4 on 11-point numerical rating scale (NRS; 0 = no pain, 10 = worst pain possible).

Verbal OA information + strengthening exercise (Control intervention): Participants in this group will receive two consultations with a physiotherapist over Zoom videoconferencing software (Zoom Video Communications, Inc., USA) over 6 weeks. Appointments will be in approximately week 1 and the second in week 6 (no appointments will be made beyond the end of week 7). The purpose of the consults will be for the physiotherapist to provide verbal OA information and to prescribe a home-based strengthening exercise program. Physiotherapists will consult from their clinic with participants based at home or wherever is suitable (e.g. work).

Verbal OA information + strengthening exercise + course (Intervention): Participants in this group will receive the same intervention as described for the control group. In addition, participants in this group will be given access to the free e-learning course, Taking Control of Your Knee and Hip Osteoarthritis, available on the online education platform FutureLearn. In consultation 1, the physiotherapist will use the Zoom 'share screen' function to orientate the participant to the e-learning registration page. Immediately following consult 1, the physiotherapist will email course access details, as well as a Microsoft Word document where participants can record questions to ask the physiotherapist related to the course content at consult 2. Participants will be instructed to complete the course in the coming 4 weeks before consultation 2. As for those in the control group, in consult 2, the physiotherapist will allow up to 10 min to address any questions the participant may have about OA and its management. For participants in this group, in addition to being asked to continue with their strengthening exercises (three times per week) until the final assessment, participants will also be encouraged to trial any other management approaches recommended within the e-learning course that may interest them.

Based on the nature of the interventions (course or no course), participants were not blinded but limited disclosure was used to blind them to what the intervention/comparator is and to the study hypothesis. Participants were told that the study is investigating two ways of providing information material about OA and its management (verbally only versus verbal plus an online resource) to see which may best support exercise prescribed by a physiotherapist via video conferencing. They were not given explicit detail about the e-learning course (experimental intervention). As the primary and secondary outcomes are participant-reported, and participants are not blinded, by default the assessors of these outcomes are not blinded. As the same physiotherapists will be delivering the interventions in both study arms, physiotherapists will not be blinded. The statistical analysis plan will be written and published while the biostatisticians are blinded to group allocation, and the main analyses will be performed while the biostatisticians are blinded to group names.

Randomisation is detailed below.

Participants were enrolled into the study and randomised once the informed consent process was completed, they had completed the baseline questionnaires online and their eligibility was re-confirmed.

A study flow-chart below represents this process.

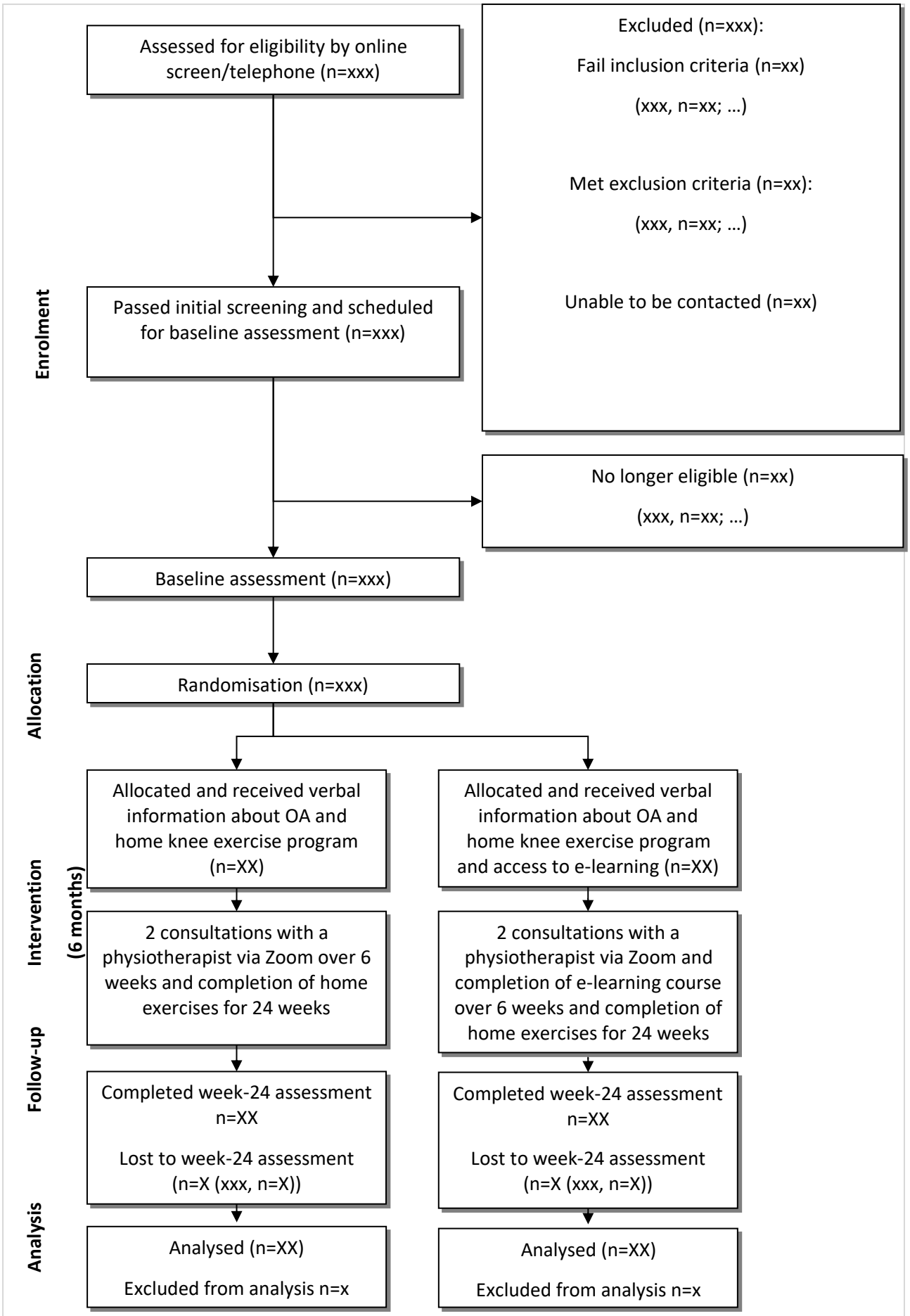
Assessed for eligibility by online screen/telephone (n=xxx)
Excluded (n=xxx):
Fail inclusion criteria (n=xx)
(xxx, n=xx; …)
Met exclusion criteria (n=xx):
(xxx, n=xx; …)
Unable to be contacted (n=xx)
Enrolment
Passed initial screening and scheduled for baseline assessment (n=xxx)
No longer eligible (n=xx)
(xxx, n=xx; …)
Baseline assessment (n=xxx)
Allocation
Randomisation (n=xxx)
Intervention (6 months)
Allocated and received verbal information about OA and home knee exercise program (n=XX)
Allocated and received verbal information about OA and home knee exercise program and access to e-learning (n=XX)
2 consultations with a physiotherapist via Zoom over 6 weeks and completion of home exercises for 24 weeks
2 consultations with a physiotherapist via Zoom and completion of e-learning course over 6 weeks and completion of home exercises for 24 weeks
Follow-up
Completed week-24 assessment n=XX
Lost to week-24 assessment (n=X (xxx, n=X))
Completed week-24 assessment n=XX
Lost to week-24 assessment (n=X (xxx, n=X))
Analysis
Analysed (n=XX)
Excluded from analysis n=x
Analysed (n=XX)
Excluded from analysis n=x

Figure 1. Study flow-chart.

3.2 Inclusion-Exclusion Criteria and General Study Population

Inclusion Criteria

Participants will be eligible for the study if they meet the following inclusion criteria:

i. live in Australia;
ii. aged 45 years or over;
iii. have an unreplaced/native knee joint with:
    a. activity-related pain at the joint;
    b. joint morning stiffness that lasts ≤ 30 mins or no morning stiffness at the joint;
    c. history of pain for ≥ 3mths at the joint; and
    d. joint pain on most days of the past month;
iv. report overall average knee pain in the past week during walking ≥ 4 on 11-point numerical rating scale (NRS; 0 = no pain, 10 = worst pain possible);
v. willing to participate in video consultations for physiotherapy appointments;
vi. have access to a computer with internet connection and an email address; and
vii. able to give informed consent and willing to commit to all study evaluation and assessment procedures.

Exclusion Criteria

i) scheduled for or planning lower limb joint surgery in the next 9 months;
ii) previous arthroplasty on the most painful knee;
iii) recent knee injection on the most painful knee (past 6 months);
iv) recent knee surgery on either knee (past 6 months);
v) consulting/ed physiotherapy or doing regular strengthening (at least once per week) exercise for knee (past 6 months);
vi) self-reported inflammatory arthritis (e.g., rheumatoid arthritis);
vii) any neurological or other condition affecting lower limbs;
viii) any unstable/uncontrolled cardiovascular condition;
ix) completed an online educational course about OA that involved at least 2 hours of learning in total in the past 12 months; and/or
x) unable to easily read and understand English.

3.3 Randomisation and Blinding

Randomisation of eligible participants to the control group or the experimental group will be conducted using randomly permuted blocks of varying sizes in a 1:1 ratio, stratified by physiotherapist. The randomisation list will be computer-generated (Software: StataCorp. 2023. Stata 18. Statistical software. StataCorp LLC) by an independent statistician and carried out centrally to ensure concealment. Based on the nature of the interventions (course or no course), participants will not be blinded but limited disclosure will be used to blind them to what the intervention/comparator is and to the study hypothesis. Participants will be told that the study is investigating two ways of providing information material about OA and its management (verbally only versus verbal plus an online resource) to see which may best support exercise prescribed by a physiotherapist via video conferencing. They will not be given explicit detail about the e-learning

course (experimental intervention). As the primary and secondary outcomes are participant-reported, and participants are not blinded, by default the assessors of these outcomes are not blinded. As the same physiotherapists will be delivering the interventions in both study arms, physiotherapists will not be blinded. The statistical analysis plan will be written and published while the biostatisticians are blinded to group allocation, and the main analyses will be performed while the biostatisticians are blinded to group names.

3.4 Study Variables

Name	Description	Scale	Time-points measured
Primary Outcomes			
Severity of knee pain during walking[17] *nrs_walking_0w, nrs_walking_24w*	Scored on an 11-point NRS for average pain on walking in the last week.	Ranges from 0 to 10; where 0=no pain and 10=worst pain possible.	Baseline, 24 weeks
Physical function subscale of the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)[46] *koos_f1_0w-koos_f17_0w, koos_f1_24w-koos_f17_24w*	Scored using 17 questions regarding knee function, with Likert response options ranging from no dysfunction to extreme dysfunction (extracted from the Knee Injury and Osteoarthritis Outcome Score (KOOS)).	Ranges from 0 (no dysfunction) to 68 (maximum dysfunction). For scoring each question, 0=None, 1=Mild, 2=Moderate, 3=Severe and 4=Extreme. Sum scores from all questions to get total score.	Baseline, 24 weeks
Secondary Outcomes			
KOOS sport and recreation subscale[21] *koos_sr1_0w- koos_sr5_0w, koos_sr1_24w-koos_sr5_24w*	Scored using 5 questions about function with sport and recreational activities in the last week, with Likert response options ranging from None to Extreme.	Scores range from 0 to 100; lower scores indicate worse function. For scoring each question, 0=None, 1=Mild, 2=Moderate, 3=Severe and 4=Extreme with total score converted to a percentage. Sum scores from all questions with total converted to a percentage.	Baseline, 24 weeks
KOOS knee-related quality of life subscale[21] *koos_q1_0w- koos_q4_0w, koos_q1_24w-koos_q4_24w*	Scored using 4 questions about knee related quality of life experienced in the last week, with 5 Likert response. options for each question.	Scores range from 0 to 100; lower scores indicate worse quality of life. For scoring each question, 0=Never/None/Not at all, 1=Monthly/Mild/Mildly, 2=Weekly/Moderate/Moderately, 3=Daily/Severe/Severely and 4=Constantly/Extreme/Extremely/Totally. Sum scores from all questions with total score converted to a percentage.	Baseline, 24 weeks

Pain self-efficacy via the pain subscale of the Arthritis Self Efficacy Scale[13] *ases_pain1_0w- ases_pain5_0w, ases_pain1_24w- ases_pain5_24w*	Scored on a 10-point NRS scale for 5 questions.	Score is the mean of items in the scale from 1-10 with higher scores indicating greater pain self-efficacy. For each question, 1=very uncertain and 10=very certain.	Baseline, 24 weeks
Self-Efficacy for Exercise scale[20] *sees_1_0w- sees_9_0w, sees_1_24w- sees_9_24w*	Using a nine-item NRS that assesses self-efficacy expectations about ability to continue exercising in the face of perceived barriers.	Total scores from 0 to 90, higher scores indicating higher self-efficacy. For each question, 0=not confident, 10= very confident. Sum scores from all questions to get total score.	Baseline, 24 weeks
Brief Fear of Movement Scale for Osteoarthritis[14] *bfoms1_0w- bfoms6_0w, bfoms1_24w- bfoms6_24w*	Scored from 6 statements regarding fear of injury/re-injury due to movement on a 4-point Likert scale.	Scores range from 6 (minimal fear) to 24 (maximal fear). For each question, 1=strongly disagree, 2=agree, 3=disagree, and 4=strongly agree. Sum scores from all questions to get total score.	Baseline, 24 weeks
Physical Activity scale for the Elderly (PASE)[21] *pase_2_0w- pase_10b_0w, pase_2_24w- pase_10b_24w*	A self-reported assessment of physical activity, covering occupational, household and leisure items over the past week with one overall value representing physical activity level.	Scores range from 0 to 400+ (theoretical maximum possible value is 1177 as Question 10a has a maximum answer of 168 hours [24 hours per day, 7 days a week]). Scores are derived using 19 questions with 2-4 Likert response (Number 2-6 without letter: 0=Never, 3=Often, number 2a and 3-6 with letter b: 1=<1hour to 4=>4 hours; number 7-10: Yes=2, No=1; 10b: 1= Mainly sitting with slight arm movements (office worker, watchmaker, seated assembly line worker, bus driver, etc.), 2= Sitting or standing with some walking (cashier, general office worker, light tool and machinery worker etc), 3= Walking with some handling of material generally weighing less than 50 pounds (mailman, waiter/waitress, construction worker, heavy tool and machinery worker etc), 4= Walking and heavy manual work, often requiring handling of materials weighing over 50 pounds (lumberjack, stone mason, farm or general labourer etc)) options except question 10a which asks 'how many hours per week did you work for pay or as a volunteer?'; higher scores indicate greater levels of physical activity. Please see Appendix A for PASE scoring instructions (Q2 = pase_2_0w/24w, etc).	Baseline, 24 weeks

Osteoarthritis Knowledge Scale (OAKS)[22] *oaks1_0w- oaks11_0w, oaks1_24w- oaks11_24w*	Scored using 11 statements regarding - osteoarthritis disease knowledge - principles of management - treatment approaches of exercise, physical activity, weight loss, surgery.	Each statement rated using a 5-point Likert scale with 1=False, 2=Possibly False, 3=Unsure, 4=Possibly True and 5=True. Items 1,2, 3, 4, 7, and 11 scored in reverse. All item scores are added for a total score range of 11 to 55. Higher scores indicate more accurate knowledge about osteoarthritis.	Baseline, 24 weeks
Brief Illness Perceptions Questionnaire (B-IPQ)[15] *bipq1_0w- bipq8_0w, bipq1_24w- bipq8_24w*	Scored from eight items that assess dimensions of: Identity, Timeline, Consequences, and Cure-Control. For each item, 'Illness' will be replaced with 'osteoarthritis'. Item 9 (open-ended question) of the B-IPQ will be captured (Please list in rank-order the three most important factors that you believe cause your knee pain), but item 9 will not be reported in this RCT but used to inform future research.	Each item is scored on a Likert scale from 0 to 10, with different and relevant endpoint descriptors. An overall score will be computed which represents the degree to which the illness is perceived as threatening or benign (range 0 to 80). To compute the score, score items 3, 4, and 7 will be reversed and added to items 1, 2, 5, 6, and 8. Higher scores represent a more threatening view of the illness.	Baseline, 24 weeks
Belief in the inevitability of needing knee joint replacement surgery *need_tkr_0w, need_tkr_24w*	Participants will be asked: 'I believe that I will need a knee joint replacement at some point'.	With response options: true, unsure, false Responses will be dichotomised into 'true' and 'false + unsure'	Baseline, 24 weeks
Global rating of change in the knee overall *gcs_overall_24w*	Scored using a 7-point global rating of change Likert scale when compared to baseline.	With response options much worse=1, moderately worse=2, slightly worse=3, no change=4, slightly better=5, moderately better=6, much better=7. Participants indicating they are moderately better or much better will be classified as 'improved'. All other	24 weeks

		respondents will be classified as 'not improved'.	
Satisfaction with treatment *satisfaction_24w*	Scored on a 7-point Likert scale.	Options are: extremely unsatisfied=1, moderately unsatisfied, slightly unsatisfied, neutral, slightly satisfied, moderately satisfied, extremely satisfied=7. Participants indicating they are moderately satisfied or extremely satisfied will be classified as 'satisfied'. All other categories will be classified as 'not satisfied'.	24 weeks
Exercise Adherence Rating Scale [23] *ears1_24w- ears6_24w*	Scored using the 6-item section B of the EARS.	Scores range from 0 to 24, with higher score indicating better adherence. Each question has a 0-4 NRS, where 0=completely agree and 4=completely disagree. Items 1, 4 and 6 are reverse scored.	24 weeks
Number of days strengthening exercises were performed (previous fortnight) *adherence_24w*	Participants will be asked "In the past two weeks, how many days did you perform the strengthening exercise program your physiotherapist prescribed for your knee problem?"	Options will range from "0 days" to "14 days". The outcome will be dichotomised into less than 6 days versus 6 to 14 days.	24 weeks
Uptake of additional physical activity *change_act_24w*	Participants will be asked to complete the sentence: "Apart from the exercises provided by my physiotherapist for this study, in the last 24 WEEKS, my physical activity levels have..."	Scored on a 5-point Likert scale with response options: Decreased significantly=1, Decreased slightly, Remained the same, Increased slightly, Increased significantly=5 Participants selecting "Increased slightly" and "Increased significantly" will be classified as having increased physical activity levels. Other categories will be classified as 'not increased'.	24 weeks
Weight loss efforts *weight_efforts_24w*	Participants will be asked "Over the past 24 WEEKS have you made any new efforts to lose weight or manage your weight? (for example,	Scored from 4 response options: I have not thought about making efforts to lose weight/manage my weight=1 I have thought about trying to lose weight/manage my weight but have not made any efforts to do so=2 I have made some small efforts to lose weight/manage my weight =3	24 weeks

	changed your diet)"	I have made a lot of effort to lose weight/manage my weight=4 Responses will be reported as number and proportion of each category.	
Oral pain medication usage *anti_inflam_tablets_0w* *analgesia_paracetamol_0w* *oral_corticosteroids_0w* *oral_opioids_0w,* *anti_inflam_tablets_24w* *analgesia_paracetamol_24w* *oral_corticosteroids_24w* *oral_opioids_24w*	Participants will self-report the use of common oral pain-relieving medications taken at least once a week in the prior month for knee pain by selecting Yes=1/No=2 from options: i. oral non-steroidal anti-inflammatory drugs ii. analgesics (paracetamol combinations), iii. oral corticosteroids and iv. oral opioids.	Number and proportion of participants using any oral pain medication for knee pain at least once a week in the prior month will be reported. The intercurrent event, pain medication, refers to the 24 week oral pain medication variables listed here.	Baseline, 24 weeks
Process Measures			
Satisfaction with physiotherapist provided OA information/education *satisfy_info_8w*	Participants will be asked "Thinking beyond the exercises your physiotherapist prescribed you, how satisfied are you with the education information your physiotherapist provided you about osteoarthritis and other management options?" Scored on a 7-point Likert scale.	Response options: extremely unsatisfied=1, moderately unsatisfied, slightly unsatisfied, neutral, slightly satisfied, moderately satisfied, extremely satisfied=7. Participants indicating they are moderately satisfied or extremely satisfied will be classified as 'satisfied'. Other categories will be classified as 'not satisfied'.	8 weeks (both groups)
E-learning course prescribed during consult *process_int1*	Participants will be asked "During your first physiotherapy consultation, did the physiotherapist tell you to access and complete (before your next appointment with them) an online	Response options: Yes=1/No=0. Reported as number and proportion reporting "Yes".	8 weeks (experimental group only)

	course about osteoarthritis and its management?"		
E-learning course access provided *process_int2*	Participants will be asked "After your first physiotherapy consultation, did the physiotherapist send you an email containing the access details to the online course about osteoarthritis and its management?"	Response options: Yes=1/No=0. Reported as number and proportion reporting "Yes".	8 weeks (experimental group only)
E-learning course program completion *process_int3i* *process_int3ii* *process_int3iii* *process_int3iv*	Four bespoke questions: 1. Did you complete module/week one, "Learning about osteoarthritis"? 2. Did you complete module/week two "Physical activity and exercise for osteoarthritis"? 3. Did you complete module/week three "Body weight and osteoarthritis"? 4. Did you complete module/week four "Additional management strategies and making a plan"?	Response options: Yes=1/No=0. Reported as number and proportion reporting "Yes".	8 weeks (experimental group only)
Perceived usefulness of E-learning course modules for OA self-management *process_int4i* *process_int4ii* *process_int4iii* *process_int4iv* *process_int4v*	Participants will answer 5 bespoke questions: 1. How useful did you find module/week one, "Learning about osteoarthritis"? 2. How useful did you find module/week two "Physical activity and exercise for osteoarthritis"? 3. How useful did you find module/week three "Body weight and osteoarthritis"? 4. How useful did you find module/week four "Additional management	Responses collected on a 4-point Likert scale with options 1= not at all useful, 2 = slightly useful, 3 = moderately useful, 4 = extremely useful. Dichotomised into 'useful' (slightly, moderately, extremely) and 'not useful' (not at all useful) and reported as number and proportion of each category.	8 weeks (experimental group only)

	strategies and making a plan"? 5. How useful did you find the course, overall?		
E-learning course access *online_accessed_24w*	Participants will be asked: Since you finished your appointments with the physiotherapist (approx. 4 months ago), have you accessed the online course they gave you again?	Response options Yes=1/No=2. Reported as number and proportion reporting "Yes".	24 weeks (experimental group only)
Number of physiotherapy sessions attended *Sessions*	Participants will self-report the number of physiotherapy consultations they attended.	Response options 0, 1, 2. For internal use only, not reported.	8 weeks
Number of physiotherapy sessions attended Session 1 treatment notes *consult1_attend:* Response options Yes=1/No=2. Missing data indicates 'No' as well. *Session 2 treatment notes consult1_attend_2:* Response options Yes=1/No=2. Missing data indicates 'No' as well.	Data extracted from the Physiotherapy clinical notes.	Reported as number and proportion attending 0, 1, 2 physiotherapy sessions.	Extracted from the physio consultation notes when provided on completion of each participants physiotherapy treatment.
Other Measures			
Achieved the minimal clinically important difference (MCID) in pain	To aid clinical interpretation, the primary outcome, knee pain severity while walking, will be dichotomised into those who do and do not achieve the MCID in improvement in knee pain (1.8 NRS units): NRS_improved_24 = 1 if change (baseline minus follow-up) in walking knee pain at 24 weeks >= 1.8, zero otherwise.	Number and proportion of participants achieving the MCID in improvement in knee pain (1.8 NRS units) will be reported.	24-weeks
Achieved the minimal clinically important	To aid clinical interpretation, the primary outcome,	Number and proportion of participants achieving the MCID in	24-weeks

difference (MCID) in function	physical function subscale of the WOMAC, will be dichotomised into those who do and do not achieve the MCID in improvement in function (6 WOMAC units). WOMAC_improved_24 = 1 if change (baseline minus follow-up) in function at 24 weeks >= 6, zero otherwise.	improvement in function (6 WOMAC units) will be reported.	
Weight *weight_24w*	Self-reported.	Measured in kilograms. Reported as change in weight since baseline. Presented in the process measures table.	24 weeks
Adverse events *adverse_24w* *problem_1_nature_24w* *problem_1_related* from REDCap™ cleaned and presented as *"serious related or possibly related adverse events"* *"non-serious related or possibly related adverse events"* *"Back pain"* *"Pelvic pain"* *"Knee pain"* from the "Adverse Events and Dropouts" excel file, "Adverse events" sheet completed after discussion of each event at the study meeting to determine if related, type and serious or not. Response options Yes=1/No=2.	Reported by participants using survey questions and defined in accordance with The Good Clinical Practice guidelines as any untoward medical occurrence in a clinical trial participant that does not necessarily have a causal relationship with the treatment.	We will report the number and proportion of participants who: - withdraw from the allocated study intervention due to a related or possibly related adverse event; - withdraw from the study due to a related or possibly related adverse event, if we are able to collect this data from those that withdraw; - experience a serious related or possibly related adverse event and types; - experience one or more non-serious related or possibly related adverse events and types. The intercurrent event, adverse events, refers to the 24 week variables listed here.	24 weeks
Other arthritis treatment use *massage_0w man_ther_0w walk_stick_0w ultrasound_0w lllt_0w tens_0w orthotics_0w knee_braces_0w heat_cold_0w exercises_0w injections_0w hydrotherapy_0w*	Participants will complete a custom-developed table to indicate the frequency of use (over the past month) of a range of co-interventions.	Participants who have used any other co-intervention once in the past month will be reported as a recent user. The intercurrent event, knee surgery, refers to the variables *arthroscopy_24w, hto_24w, reconstruct_24w* and *replacement_24w*.	Baseline, 24 weeks

acupuncture_0w arthroscopy_0w hto_0w reconstruct_0w replacement_0w, massage_24w man_ther_24w walk_stick_24w ultrasound_24w lllt_24w tens_24w orthotics_24w knee_braces_24w heat_cold_24w exercises_24w injections_24w hydrotherapy_24w acupuncture_24w arthroscopy_24w hto_24w reconstruct_24w replacement_24w			
Use of courses about OA (control only) *oa_course_24w*	Participants will be asked: "Since you started this study (6 months ago), have you done any educational courses about osteoarthritis and its management that involved at least 2 hours of learning?"	Response options Yes=1/No=2. The number and proportion reporting "yes" will be reported in the process measures table.	24 weeks (control only)
Baseline Descriptive Measures			
Height *height_0w*	Self-reported.	Measured in metres.	Baseline
Weight *weight_0w*	Self-reported.	Measured in kilograms.	Baseline
Body mass index (BMI) =weight_0w/(*height_0w* height_0w)*	Calculated from height and weight.	Reported in kg/m^2.	Baseline
Age *Age* Derived in REDCap™ as *age=date_randomised – dob* (in years) as *dob* data not exported from REDCap™.	Calculated from date of birth.	Reported in years.	Baseline
Sex *Sex*	Self-reported via "What was your sex recorded at birth?"	Response options: Male=1, Female=2. Number and proportion of participants in each category will be reported.	Baseline
Gender *Gender*	Self-reported.	Response options: Man=1, Woman=2, Non-binary=3, Prefer not to say=4.	Baseline

		Number and proportion of participants responding to each category will be reported.	
Ethnicity *Ethnicity*	Self-reported.	Response options: Australian/New Zealander=1, Aboriginal and Torres Strait Islander=2, European=3, Asian=4, Other Oceania=5, North African & Middle Eastern=6, Sub-Saharan African=7, North American=8, South American=9, Other (please list)=10 Number and proportion of participants responding to each category will be reported.	Baseline
Laterality of knee OA *Unilateral*	During screening participants will self-report if they have symptoms in one knee or both knees.	Response options: 1= Unilateral, 2= Bilateral. Reported as number and percentage of those reporting to have bilateral symptoms (symptoms in both knees).	Baseline
Duration of symptoms *symptom_duration*	Participants will self-report the total duration of time since their study knee symptoms began.	Reported in years.	Baseline
Geographical location *Remoteness*	Determined based on residential postcode and classified according to the Australian Standard Geographical Classification (ASGC) Remoteness Structure[24].	Response options: 1= Major city, 2= Inner regional, 3= Outer regional, 4= Remote, 5= Very remote. The number and proportion of participants living in major cities, inner regional, outer regional, remote and very remote locations will be reported (with categories outer regional, remote and very remote likely collapsed into one category due to small numbers).	Baseline
Education level *Education*	Participants will report their highest obtained education level using a categorical scale.	Response options: 1= Did not complete primary school, 2= Primary school, 3= Secondary school, 4= Trade or trade certificate, 5= University or tertiary institute, 6= Higher university degree, 7= Don't know/unsure. The number and proportion of respondents for each category will be reported.	Baseline
Current employment status	Self-reported current employment status in	Response options: 1= Yes, 2= No.	Baseline

employment_status	response to the question: Are you currently in paid employment (casual, part time or full time)?	Number and proportion of participants in paid employment will be reported.	
Financial situation *Financial*	Participants will be asked "How would you describe your financial situation?" and self-report from 6 options.	Response options: 1= Find it a strain to get by from week to week, 2= Have to be careful with money, 3= Able to manage without much difficulty, 4= Quite comfortably off, 5= Very comfortably off, 6= Prefer not to answer. The number and proportion of respondents for each category will be reported.	Baseline
Comorbidities *heart hbp lung diab ulcer kidney liver anemia cancer dep osteo back ra other_prob*	Reported using the Self-Administered Comorbidity Questionnaire[25].	Response options: 1= Yes, 2= No. The number and proportion of participating reporting each comorbidity will be reported.	Baseline
Expectation of treatment outcome *treat_exp*	Rated using a 5-point Likert scale.	Options: 1= No effect at all, 2= Minimal improvement, 3= Moderate improvement, 4 = Large improvement, 5= Complete recovery. The number and proportion of participants selecting each response option will be reported.	Baseline

4 Sample Size

There are two primary outcomes: WOMAC physical function and NRS pain scale. A total sample size of 136 (68 per arm) is required to detect a minimally clinically important difference of 6 WOMAC points[26] between the two treatment arms with 80% power and an alpha of 0.025 (alpha of 0.05 split between the two primary outcomes), assuming a correlation of 0.35 between baseline and 24 weeks follow-up, a standard deviation (SD) of 11 WOMAC points and 15% loss to follow-up.[27,28]

This sample size is more than sufficient to detect a minimally clinically important difference of 1.8 NRS points in the NRS pain scale[29] with >98% power and 15% loss to follow-up, assuming a SD of 2.3 NRS points and correlation of 0.35 between baseline and 24 weeks follow-up.[27,28]

5 General Considerations

5.1 Timing of Analyses

The final analysis will be performed after all randomised participants have had the opportunity to complete final data collection on data transferred to the files "PEEKO_DATA_NOHDRS_202Y-MM-DD_TTTT" and "Adverse Events and Dropouts", having been documented as meeting the cleaning and approval requirements of "SOP03 CHESM Data Collection and Storage_v1.0" and

"PEEKO_MISCH_Data Cleaning_V1" and after the finalisation, approval and publication on our research centre's website of this SAP document.

Study data entered and stored in the study database will be transferred to the trial biostatistician. After the last participant has concluded study participation, all study data are available, and all study data have been cleaned, a blinded review will be undertaken with the subgroup of the study team consisting of the principal investigator, project manager and study biostatisticians prior to database lock. During the blinded data review meeting, the following topics will be discussed and decided upon without knowledge of the underlying treatment code:

1. Participants who have withdrawn consent, in relation to the use of the participant's data (or part of it) in any of the analyses.

2. Participant's inclusion or exclusion status with regards to the "as randomised" and "as treated" treatment group (e.g., in the case of misallocation). The exact process for assigning the statuses will be defined and documented in the minutes of the meeting prior to unblinding to study name along with the reason for classifying "as randomised" and "as treated".

3. Participant's inclusion or exclusion status with regards to each analysis population.

4. Participant's intercurrent events, in relation to the intercurrent event handling in the analysis of the participant's data (or part of it). Intercurrent events will be listed and tabulated for the purpose of the blinded data review meeting.

After database lock, the randomisation code will be obtained from the independent statistician who generated the randomisation code and added to the study database by the trial statistician. No database may be locked, randomisation code unmasked, or analyses completed until the SAP has been approved (in case of updates since its initial approval). The planned analyses in this SAP will be conducted after unmasking of the randomisation code and any changes to this SAP after unmasking will be documented in an amendment of this SAP and considered post-hoc analyses.

5.2 Analysis Populations

5.2.1 Full Analysis Population

The full analysis population will consist of all participants who were randomised and who did not withdraw all their data, as documented in the minutes of the blinded data review meeting. This population will be used for all analyses and summaries presented including background, safety and efficacy data.

5.3 Covariates and Subgroups

All models will adjust for baseline values, where relevant, and the stratifying variable of physiotherapist.

To assess whether the treatment effect differs for different subgroups, exploratory analyses will be undertaken which include interaction terms between treatment arm and each potential moderator (as continuous variables) in the models for the primary outcomes:

To explore potential moderators (baseline participant characteristics) of treatment effect on the primary outcomes, based on the following *a priori* hypotheses (based on theoretical rationale) including:

a. OA knowledge (OAKS): those with lower knowledge at baseline will have greater improvements in pain and function with the e-learning course compared to no e-learning course;
b. self-efficacy (Arthritis Self-Efficacy Scale): those with lower pain SE at baseline will have greater improvements in pain and function with the e-learning course compared to no e-learning course;
c. fear of movement (Brief Fear of Movement Scale for Osteoarthritis[14]): those with higher fear of movement at baseline will have greater improvements in pain and function with the e-learning course compared to no e-learning course;
d. Brief Illness Perceptions Questionnaire (B-IPQ): those with a more threatening view of OA and its prognosis at baseline will have greater improvements in pain and function with the e-learning course compared to no e-learning course.

Results of the subgroup analyses will be presented in a table including the interaction effect estimate, two-sided 95% confidence interval (CI) and associated p-value as well as the estimate and associated 95% CI for the effect by group. Forest plot figures may be used to communicate the relevant information about possible subgroup effects and interactions.

As the study was not powered to detect these interaction effects, it is likely that subgroup analyses are underpowered.

5.4 Missing Data

If missing data are present, an appendix table will provide summaries of baseline characteristics and baseline levels of primary and secondary outcomes where measured between two groups: those participants who provide both primary outcomes post-intervention, and those participants who are missing either or both primary outcomes.

If less than 5% of data for both primary outcomes are missing, missing data will be assumed Missing Completely At Random (MCAR). This means the cause of the data being missing is unrelated to the missing or observed data and that analyses of complete data should provide an unbiased estimate of the effect that would be estimated should all participant data be available. Linear regression analyses of primary and secondary outcomes will be performed on complete case data (i.e., participants with missing data will be dropped from analyses).

Should the amount of missing data for either primary outcome at 24 weeks be greater than 5%, missing data will be assumed Missing At Random (MAR). This means we will assume that differences between missing and observed values can be explained by other observed values, such as baseline variables. Multiple imputation will be conducted to impute data for all outcomes under this assumption. The primary analysis for all outcomes will then use a multiply imputed dataset, with a sensitivity analysis using complete case data for each outcome. Multiple imputation will still be valid if data are actually MCAR and not MAR. If data are actually MCAR, multiple imputation will improve precision by increasing the sample size.

Missing baseline characteristics will be imputed using single mean imputation for continuous variables and imputation of the most frequent value for categorical variables. Missing outcomes at follow-up will be imputed using chained equations with predictive mean matching and five nearest

neighbours for continuous and binary outcomes. Imputation models for outcomes will include all primary and secondary outcomes at both baseline and post-intervention timepoints, along with age, sex, BMI, ethnicity, geographical location, education level, employment status, comorbidities, laterality and duration of knee symptoms, financial situation and expectation of treatment outcome. Data will be imputed for each treatment group separately. The number of imputed data sets created will be based on the percentage of participants in the sample with missing outcome data (e.g., 15 imputed datasets if 15% of participants have missing data) or a minimum of 10 imputed datasets, whichever is greater. Initially, imputation models will include all primary and secondary outcomes together, with outcomes broken into subsets if imputation models do not converge. Imputed datasets will be compared to complete data using density plots for continuous outcomes and descriptive tabulations for the binary outcomes. Estimates from the imputed datasets will be combined using Rubin's rules[30].

Results using complete case datasets (that assume MCAR) and multiply imputed datasets (that assume missing data is MAR) may be biased if missing data are actually Missing Not At Random (MNAR), which means that data that is missing is missing due to the missing data value itself. If more than 5% of either primary outcome at 24 weeks is missing, then sensitivity analyses will be conducted using the delta-adjustment method under the pattern-mixture modelling framework in the context of multiple imputation to assess sensitivity to MNAR for the primary outcomes with a range of plausible delta parameters for the two primary continuous outcomes[31].

5.5 Interim Analyses and Data Monitoring

No interim analyses will be performed. As this was a low-risk trial, no data safety monitoring board (DSMB) was required. Adverse events were self-reported by participants at 24-weeks follow-up.

5.6 Multiple Testing

The two-sided 5% significance level will be split equally across the two primary outcomes (alpha level of 0.025 each primary outcome): multiplicity-adjusted two-sided 95% confidence intervals and multiplicity-adjusted p-values will be reported for the two primary outcomes.

We have several secondary outcomes, which are exploratory and not powered for. We will therefore not adjust for multiple secondary outcomes; instead, the estimates and unadjusted 95% CIs will be reported in order to let readers use their own judgment about the relative weight of the conclusions regarding the effect of intervention on secondary outcomes. This approach aligns with the approach favoured by the American Statistical Association[32].

5.7 Intercurrent Events

Intercurrent events are events that occur post-randomisation and may preclude the observation of the outcome variable or affect its measurement. Intercurrent events will be tracked by the study team during the study. Data will be reviewed prior to the closure of the database to ensure all intercurrent events are captured. Possible intercurrent events include the following:

- A participant receiving a different intervention than what they were allocated to
- Adverse events
- Pain medication
- Knee surgery

Intercurrent events will be summarised by treatment group.

6 Summary of Study Data

All approximately symmetrically distributed continuous variables will be summarised using the following descriptive statistics: n (non-missing sample size), mean, standard deviation, while other continuous variables will be summarised as n (non-missing sample size), median, 25th and 75th percentiles (interquartile range). The count and percentages (based on the non-missing sample size) of observed levels will be reported for all categorical measures. In general, all data will be listed, sorted by treatment group. All summary tables will be structured with a column for each treatment in the order (Control, Intervention) and will be annotated with the total population size relevant to that table/treatment, including any missing observations, if relevant, in either the table or a footnote of the table.

The sample size of non-missing values for univariable summary statistics may be larger than the sample size of non-missing values in a complete-case analysis used in the primary regression analysis, as different participants may have missing values in different variables, such as baseline covariates and the endpoints.

6.1 Participant Disposition

The flow of participants will be presented in a Consolidated Standards of Reporting Trials (CONSORT) diagram as per Figure 1 in Section 3, according to the CONSORT statement and relevant extensions[33]. The following will be reported:

- Number of participants assessed for eligibility (count of participants listed in Recruitment Database)
- Number of participants ineligible by online screen or by telephone: sum of number failed inclusion criteria (count of relevant variable from Recruitment Database), number met exclusion criteria (count of relevant variable from Recruitment Database), declined participation (count of relevant variable in Recruitment Database), and people who were no longer eligible (e.g., pain lower than 4/10 at enrolment)
- Number of participants completing baseline assessment (count of '2'=complete for 'peeko_baseline_questionnaire_complete' variable from REDCap™ PEEKO Baseline Questionnaire form)
- Number of participants randomised (count of 'study_id' variable from PEEKO Baseline Questionnaire form in REDCap™)
- Number of participants allocated to each of the two intervention arms (count for each group number in 'group' variable in PEEKO Baseline Questionnaire form in REDCap™)
- Number of participants at follow-up (count of non-missing values of 'nrs_walking_24w' or 'koosa124w' to 'koosa17_24w' variables from REDCap™ PEEKO 24 Week Questionnaire, whichever is more) and who were lost to follow-up (count of missing values of 'nrs_walking_24w' or 'koosa124w' to 'koosa17_24w' variables from REDCap™ PEEKO 24 Week Questionnaire, whichever is less)
- Number of participants included in the intention-to-treat analysis of each primary outcome (count of non-missing values of 'nrs_walking_24w' and 'koos_f1_24w' to 'koos_f17_24w' variables from REDCap™ 24 Week Questionnaire form if not missing outcome at baseline ('nrs_walking_0w' and 'koos_f1_24w' to 'koos_f17_24w' variables), nor 'group_allocation')

6.2 Derived variables

All outcomes are derived variables (See Section 3.4).

Endpoints derived from a variable or variables calculated from source data, then their definition is provided in Section 3.4.

6.3 Protocol Deviations

Any protocol deviations including errors applying inclusion/exclusion criteria and/or administration of the wrong intervention will be documented, if they occur, in the findings manuscript with the trial results (patient flow diagram/text). The number of participants who were allocated the incorrect intervention will be reported overall and by treatment arm. All participants will be analysed according to randomised treatment arm in the intention-to-treat analysis, irrespective of these deviations. In sensitivity analysis, participants will be analysed according to the treatment they received, irrespective of what they were randomised to. Sensitivity analysis will be performed only for the primary outcomes.

6.4 Demographic and Baseline Variables

Baseline variables are listed in Section 3.4. There are no deviations in presentation of baseline variables from section 6. Demographic and baseline characteristics of participants will be visually inspected to assess baseline comparability of treatment groups. No p-values will be reported to compare baseline variables between the two treatment arms.

6.5 Concurrent Illnesses and Medical Conditions

The coding system for comorbidities is as per section 3.4. Participants will report at baseline any comorbidities and will report any adverse events at 24 weeks. The information will be collated in the descriptive statistics table for baseline data, and adverse events and cointerventions table for adverse event data at 24 weeks. No p-values will be reported to compare variables between the two treatment arms.

6.6 Prior and Concurrent Medications and Cointerventions

The coding system for medications and cointerventions is as per section 3.4. Participants will report at baseline and follow-up (24 weeks) if they were receiving certain oral pain medications and cointerventions. This information will be collated in the descriptive statistics table, the binary outcomes table (any oral pain medication usage) and the adverse events and cointerventions table. Participants who indicate they have used a drug/supplement at least once a week in the past month will be reported as a current user of the relevant medication. Participants who have used a co-intervention listed in section 3.4 once in the past month will be reported as a user. This will be summarised by control/intervention group. If there is missing data, the non-missing sample will be reported either in the table or in the footnote of the table. No p-values will be reported to compare the two treatment arms.

6.7 Treatment Compliance

Adherence to the prescribed exercise program (3xweek) will be captured in self-report secondary outcomes: Exercise Adherence Rating Scale[23] and Number of days strengthening exercises were performed (previous fortnight) (see Section 3.4) and presented in summary tables as well as possibly the process measures table, if required. Additional measures of participant adherence, process variables, are listed and detailed in Section 3.4. Data from these process measures will be reported using descriptive statistics as appropriate for each treatment group in the process measures table.

7 Efficacy Analyses

A Statistical Analysis Plan will be written and published on our research centre's website prior to commencement of data analysis while blind to group allocation. Analyses comparing the two groups will be performed by the statistician blind to group details according to the intention-to-treat principle.

7.1 Primary Efficacy Analysis

The primary estimand is defined according to the addendum to the ICH E9 on estimands and sensitivity analysis in clinical trials[34]. PEEKO aims to answer the specific research questions: does the addition of the e-learning course to verbal OA information and a home-based strengthening exercise program prescribed over 2 consultations with a physiotherapist improve the primary outcomes of i) knee pain severity during walking and/or ii) WOMAC physical function at 24- weeks for people with knee OA?

Primary estimand attributes:

- Treatment: e-learning course plus verbal OA information and a home-based strengthening exercise program prescribed over 2 consultations with a physiotherapist (intervention) compared to no e-learning course, only verbal OA information and a home-based strengthening exercise program prescribed over 2 consultations with a physiotherapist (control), allocation by randomisation.

- Population: Adults who live in Australia, are aged 45 years or over, have an unreplaced/native knee joint with: a) activity-related pain at the joint; b) joint morning stiffness that lasts ≤ 30 mins or no morning stiffness at the joint; c) history of pain for ≥ 3mths at the joint; and d) joint pain on most days of the past month, who also report overall average knee pain in the past week during walking ≥ 4 on 11-point numerical rating scale (NRS; 0 = no pain, 10 = worst pain possible), are willing to participate in video consultations for physiotherapy appointments, have access to a computer with internet connection and an email address and are able to give informed consent and willing to commit to all study evaluation and assessment procedures.

- Variables: i) knee pain severity during walking at 24 weeks post-randomisation; ii) WOMAC physical function at 24 weeks post-randomisation.

- Intercurrent events: Possible intercurrent events outlined in Section 5.7 will be handled using the treatment policy strategy.

- Population level summaries: i) mean difference (at follow up) in knee pain severity during walking between arms (intervention versus control) and ii) mean difference (at follow up) in WOMAC physical function between arms (intervention versus control).

The number and percentage of participants who had intercurrent events will be described overall and by treatment arm in either text or relevant tables.

The primary hypothesis is that participants allocated to the group receiving the e-learning course will have greater improvements in knee pain during walking and/or self-reported physical function at 24-weeks compared to those allocated to the control group.

For the continuous primary outcomes, mean differences at 24-weeks will be compared between groups using separate linear regression models for each outcome adjusted for baseline levels of the relevant outcome and the stratifying variable, physiotherapist. Model assumptions will be assessed using standard diagnostic plots.

The primary hypotheses will be evaluated using the estimate, multiplicity adjusted two-sided 95% confidence interval, and the multiplicity adjusted p-value of the i) mean difference at 24-weeks follow

up in severity of knee pain while walking between the two treatment arms and ii) mean difference at 24-weeks follow up in WOMAC physical function between the two treatment arms.

If multiple imputation is used in the primary analysis, sensitivity analysis for the primary outcomes will be undertaken using complete case analysis.

7.2 Secondary Efficacy Analyses

The following secondary outcomes will be treated as continuous outcomes and will be analysed similarly to the primary outcomes, and targeting a similar estimand at 24-weeks: KOOS knee-related quality-of-life; KOOS sport and recreation; self-efficacy for exercise; pain self-efficacy, physical activity levels; OA knowledge; perceptions of OA (illness perceptions); fear of movement; and exercise adherence (EARS).

For continuous secondary outcomes, mean differences at 24-weeks will be compared between groups using separate linear regression models for each outcome adjusted for baseline levels of the relevant outcome, if available, and the stratifying variable, physiotherapist. Model assumptions will be assessed using standard diagnostic plots.

To aid clinical interpretation, the primary outcomes, knee pain severity while walking and the physical function subscale of the WOMAC, will be dichotomised into those who do and do not achieve the MCID in improvement in knee pain (1.8 NRS units) and function (6 WOMAC units), respectively. For these and other binary outcomes (belief in inevitability of needing a knee joint replacement; global rating of change; satisfaction with treatment; exercise adherence [strengthening exercises performed 0 to 6 vs 6 to 14 days per fortnight], uptake of additional physical activity and any oral pain medication use), groups will be compared using risk differences and risk ratios, calculated from logistic regression models and adjusted for baseline values of the relevant outcome, if available, and the stratifying variable, physiotherapist.

For the ordinal outcome, weight loss efforts, ordinal logistic regression models will be fitted, adjusted for the stratifying variable, physiotherapist. Then, the proportional odds assumption will be assessed using the Brant test[35]. If the Brant test cannot be computed, then the proportional odds assumption will be assessed using the likelihood-ratio test[36,37]. If the proportional odds cannot be assumed, multinomial regression models will be fitted, adjusted for the stratifying variable, physiotherapist. Results will be reported as odds ratios, or relative risk ratios if multinomial regression is used, with corresponding 95% CIs.

Unadjusted (for multiplicity) 95% confidence intervals will be reported for all secondary outcomes.

7.3 Exploratory Efficacy Analyses

It is anticipated that not all participants will complete all modules of the intervention. Therefore, the analysis undertaken for the primary estimand will only provide an estimate of the causal effect of intervention assignment rather than an estimate of the causal effect of the intervention actually received. A sensitivity analysis will estimate treatment effects on the primary outcomes at 24-weeks assuming 'acceptable' adherence to (that is, completion of) all modules of the course ('acceptable' adherence defined as completing all 4 modules). Complier average causal effects will be estimated using an instrumental variables approach (where randomisation is the instrument for adherence). Two-stage least squares models will be fitted[38] with complier average causal effects and associated unadjusted 95% confidence intervals reported.

Other than exploratory analyses already listed, no further exploratory analyses will be undertaken.

8 Safety Analyses

In this trial, related adverse events are defined as "any problem experienced in the study knee or elsewhere in the body deemed to be a result of participating in the trial and at least one of i) caused negative/adverse symptoms/effects for two days or more, and/or ii) resulted in the participant seeking treatment or taking medication". Adverse events will be ascertained by survey questions to participants at 24 weeks.

The following will be reported:

- the number (and proportion) of participants reporting one or more non-serious related adverse events for each treatment group as outlined in the full analysis population section and the number (and proportion) of participants reporting each type of non-serious related adverse event;

- the number (and proportion) of participants that experience one or more serious related adverse events and the number (and proportion) of participants reporting each type of serious related adverse event (defined as any untoward medical occurrence that i) results in death; ii) is life-threatening; iii) requires hospitalisation or prolongation of existing inpatient hospitalisation; iv) results in persistent or significant disability or incapacity; v) is a congenital anomaly or birth defect, or; vi) any other important medical condition which, although not included in the above, may require medical or surgical intervention to prevent one of the outcomes listed);

- the number and proportion of participants that withdraw from the study interventions due to a related or possibly related adverse event (if a participant(s) has/have notified us of this);

- the number and proportion of participants that withdraw from the trial due to a related or possibly related adverse event (if a participant(s) has/have notified us of this and we are able to collect this data).

9 Reporting Conventions

The standard deviation will be reported with mean values, and interquartile range (25th and 75th percentiles) with the median. Percentages will be reported without decimal points, and percentages less than 1% will be presented as <1% unless % is zero.

P-values ≥0.001 will be reported to 3 decimal places; p-values less than 0.001 will be reported as “<0.001”. The mean, standard deviation, and any other statistics other than quantiles, will be reported to one decimal place greater than the original data. Quantiles, such as median, interquartile range or minimum and maximum will use the same number of decimal places as the original data. In any cells in a row of data for which no data are reported, NA (Not Applicable) or two mid-dots (··) will be included in the table and NA (Not Applicable) as a footnote.

For publication purposes, if the target journals guidelines differ in their reporting conventions to those listed above, the reporting will change to reflect the guidelines of the journal.

10 Technical Details

Analysis will be conducted using Stata/SE for Windows version 18.

A second review statistician will independently reproduce the primary analyses and the table containing the primary outcome regression results. The reviewing statistician will have an overview of the entire analyses and will explicitly check the code producing the other tables (selected at random) as well as any other pieces of code as desired.

To provide high quality code that is understandable, and allows reproduction of the analysis, a log capturing the version of the software and any external add-on code will be used. Also, at the start of any code file there will be a set of comments that give:

- the author
- the date of writing
- references to inputs and outputs

11 Summary of Changes to the Protocol

The following changes to the protocol are made in this statistical analysis plan:

- Intercurrent Events: The reporting of intercurrent events is detailed in the SAP.
- Estimand Framework: The use of the estimand framework to define how the treatment effect will be estimated is outlined in the SAP.

12 References

1. Australian Institute of Health and Welfare. *Osteoarthritis*. 2020. https://www.aihw.gov.au/reports/chronic-musculoskeletal-conditions/osteoarthritis
2. RACGP. *Guideline for the management of knee and hip osteoarthritis*. 2018.
3. Fransen M, McConnell S, Harmer AR, Van der Esch M, Simic M, Bennell KL. Exercise for osteoarthritis of the knee: a Cochrane systematic review. *Br J Sports Med*. Dec 2015;49(24):1554-7. doi:10.1136/bjsports-2015-095424
4. de Oliveira BIR, Smith AJ, O'Sullivan PPB, et al. 'My hip is damaged': a qualitative investigation of people seeking care for persistent hip pain. *British journal of sports medicine*. Jul 2020;54(14):858-865. doi:10.1136/bjsports-2019-101281
5. Bunzli S, O'Brien P, Ayton D, et al. Misconceptions and the Acceptance of Evidence-based Nonsurgical Interventions for Knee Osteoarthritis. A Qualitative Study. *Clinical orthopaedics and related research*. Sep 2019;477(9):1975-1983. doi:10.1097/corr.0000000000000784
6. O'Brien P, Bunzli S, Ayton D, Dowsey MM, Gunn J, Manski-Nankervis JA. What are the patient factors that impact on decisions to progress to total knee replacement? A qualitative study involving patients with knee osteoarthritis. *BMJ open*. Sep 24 2019;9(9):e031310. doi:10.1136/bmjopen-2019-031310
7. Dobson F, Bennell KL, French SD, et al. Barriers and Facilitators to Exercise Participation in People with Hip and/or Knee Osteoarthritis: Synthesis of the Literature Using Behavior Change Theory. *American journal of physical medicine & rehabilitation*. May 2016;95(5):372-89. doi:10.1097/phm.0000000000000448
8. Goff AJ, De Oliveira Silva D, Merolli M, Bell EC, Crossley KM, Barton CJ. Patient education improves pain and function in people with knee osteoarthritis with better effects

when combined with exercise therapy: a systematic review. *J Physiother*. Jul 2021;67(3):177-189. doi:10.1016/j.jphys.2021.06.011
9. Briggs AM, Houlding E, Hinman RS, et al. Health professionals and students encounter multi-level barriers to implementing high-value osteoarthritis care: a multi-national study. Article. *Osteoarthritis and Cartilage*. 05/01/May 2019 2019;27(5):788-804. doi:10.1016/j.joca.2018.12.024
10. Wluka A, Chou L, Briggs A, Cicuttini F. *Understanding the needs of consumers with musculoskeletal conditions: Consumers' perceived needs of health information, health services and other non-medical services: A systematic scoping review.* 2016.
11. Nelligan RK, Hinman RS, Egerton T, et al. Effects of a Massive Open Online Course on osteoarthritis knowledge and pain self-efficacy in people with hip and/or knee osteoarthritis: protocol for the MOOC-OA randomised controlled trial. *BMC musculoskeletal disorders*. May 15 2023;24(1):381. doi:10.1186/s12891-023-06467-x
12. Darlow B, Krägeloh C, Abbott JH, et al. The osteoarthritis knowledge scale. *Musculoskeletal care*. Dec 27 2022;doi:10.1002/msc.1727
13. Lorig K, Chastain RL, Ung E, Shoor S, Holman HR. Development and evaluation of a scale to measure perceived self-efficacy in people with arthritis. *Arthritis Rheum*. Jan 1989;32(1):37-44.
14. Shelby RA, Somers TJ, Keefe FJ, et al. Brief Fear of Movement Scale for osteoarthritis. *Arthritis Care Res (Hoboken)*. Jun 2012;64(6):862-71. doi:10.1002/acr.21626
15. Broadbent E, Petrie KJ, Main J, Weinman J. The Brief Illness Perception Questionnaire. *Journal of Psychosomatic Research*. 2006/06/01/ 2006;60(6):631-637. doi:https://doi.org/10.1016/j.jpsychores.2005.10.020
16. McAlindon TE, Driban JB, Henrotin Y, et al. OARSI Clinical Trials Recommendations: Design, conduct, and reporting of clinical trials for knee osteoarthritis. *Osteoarthritis Cartilage*. May 2015;23(5):747-60. doi:10.1016/j.joca.2015.03.005
17. Bellamy N. Osteoarthritis clinical trials: candidate variables and clinimetric properties. *Journal of Rheumatology*. 1997;24(4):768-778.
18. Bellamy N, Buchanan WW, Goldsmith CH, Campbell J, Stitt LW. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of the hip or knee. *The Journal of rheumatology*. Dec 1988;15(12):1833-40.
19. Roos EM, Roos HP, Lohmander LS, Ekdahl C, Beynnon BD. Knee Injury and Osteoarthritis Outcome Score (KOOS)--development of a self-administered outcome measure. *J Orthop Sports Phys Ther*. Aug 1998;28(2):88-96. doi:10.2519/jospt.1998.28.2.88
20. Resnick B, Jenkins LS. Testing the reliability and validity of the Self-Efficacy for Exercise scale. *Nursing research*. May-Jun 2000;49(3):154-9.
21. Martin KA, Rejeski WJ, Miller ME, James MK, Ettinger WH, Jr., Messier SP. Validation of the PASE in older adults with knee pain and physical disability. *Medicine and science in sports and exercise*. May 1999;31(5):627-33.
22. Darlow B, Abbott H, Bennell K, et al. Knowledge about osteoarthritis: Development of the Hip and Knee Osteoarthritis Knowledge Scales and protocol for testing their measurement properties. *Osteoarthritis and Cartilage Open*. 2021/06/01/ 2021;3(2):100160. doi:https://doi.org/10.1016/j.ocarto.2021.100160
23. Newman-Beinart NA, Norton S, Dowling D, et al. The development and initial psychometric evaluation of a measure assessing adherence to prescribed exercise: the Exercise Adherence Rating Scale (EARS). *Physiotherapy*. Jun 2017;103(2):180-185. doi:10.1016/j.physio.2016.11.001
24. Australian Statistical Geography Standard (ASGS) Edition 3. https://www.abs.gov.au/statistics/standards/australian-statistical-geography-standard-asgs-edition-3/jul2021-jun2026/remoteness-structure

25. Sangha O, Stucki G, Liang MH, Fossel AH, Katz JN. The Self-Administered Comorbidity Questionnaire: a new method to assess comorbidity for clinical and health services research. *Arthritis Rheum*. Apr 15 2003;49(2):156-63. doi:10.1002/art.10993
26. Angst F, Aeschlimann A, Stucki G. Smallest detectable and minimal clinically important differences of rehabilitation intervention with their implications for required sample sizes using WOMAC and SF-36 quality of life measurement instruments in patients with osteoarthritis of the lower extremities. *Arthritis Rheum*. Aug 2001;45(4):384-91. doi:10.1002/1529-0131(200108)45:4<384::Aid-art352>3.0.Co;2-0
27. Bennell KL, Nelligan R, Dobson F, et al. Effectiveness of an Internet-Delivered Exercise and Pain-Coping Skills Training Intervention for Persons With Chronic Knee Pain: A Randomized Trial. *Ann Intern Med*. Apr 4 2017;166(7):453-462. doi:10.7326/m16-1714
28. Hinman RS, Kimp AJ, Campbell PK, et al. Technology versus tradition: a non-inferiority trial comparing video to face-to-face consultations with a physiotherapist for people with knee osteoarthritis. Protocol for the PEAK randomised controlled trial. *BMC musculoskeletal disorders*. 2020/08/07 2020;21(1):522. doi:10.1186/s12891-020-03523-8
29. Bellamy N, Carette S, Ford P, et al. Osteoarthritis antirheumatic drug trials. II. Tables for calculating sample size for clinical trials. *The Journal of rheumatology*. 1992;19(3):444-450.
30. Carpenter JR, Bartlett JW, Morris TP, Wood AM, Quartagno M, MG K. *Multiple imputation and its application*. John Wiley & Sons; 2023.
31. Rezvan PH, Lee KJ, JA. S. Sensitivity analysis within multiple imputation framework using delta-adjustment: Application to Longitudinal Study of Australian Children. Longitudinal and Life Course Studies. *Longitudinal and Life Course Studies*. 2018;9(3):259–78.
32. Wasserstein R, Schirm A, Lazar N. *Moving to a world beyond "p< 0.05"*. Taylor & Francis; 2019.
33. Boutron I, Moher D, Altman DG, Schulz KF, Ravaud P. Extending the CONSORT statement to randomized trials of nonpharmacologic treatment: explanation and elaboration. *Ann Intern Med*. Feb 19 2008;148(4):295-309. doi:10.7326/0003-4819-148-4-200802190-00008
34. Committee for Medicinal Products for Human Use. ICH E9 (R1) addendum on estimands and sensitivity analysis in clinical trials to the guideline on statistical principles for clinical trials. Amsterdam, the Netherlands: European Medicines Agency. 2020;
35. Long JS, J. F. *Regression Models for Categorical and Limited Dependent Variables Using Stata. 2nd edn. College Station, Texas: Stata Press.* 2006.
36. Wolfe F, Smythe HA, Yunus MB, et al. The American College of Rheumatology 1990 Criteria for the Classification of Fibromyalgia. Report of the Multicenter Criteria Committee. *Arthritis and rheumatism*. 1990;33(2):160-172. doi:10.1002/art.1780330203
37. Wolfe R, Gould W. omodel: Maximum-likelihood ordered logit and probit estimation. Stata help file (Statalist, 1 Sept 1997) and Stata module (omodel.ado, omodel.hlp). Boston College RePEc/BOCODE. Available from: http://fmwww.bc.edu/RePEc/bocode/o/omodel.hlp.
38. *Stuart EA, Perry DF, Le H-N, Ialongo NS. Estimating intervention effects of prevention programs: Accounting for noncompliance. Prevention Science. 2008;9(4):288–98. .*

13 Listing of Tables and Figures

Table 1. Baseline characteristics of participants, by treatment group, reported as mean (standard deviation) unless otherwise stated.

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eTable 8. Baseline characteristics and baseline levels of outcomes of participants who provided both primary outcomes at 24-weeks and those participants who did not, reported as mean (standard deviation) unless otherwise stated.

eTable 9. Effects of the intervention on the primary outcomes at 24-weeks assuming acceptable adherence (with acceptable adherence defined as completing all 4 modules of the e-learning course).

NOTE:

The population set for all tables will be the 'as randomised' full analysis population.

If <5% of primary outcome data at 24-weeks is missing, then missing data will not be imputed and only results using complete case data will be presented.

If >5% of primary outcome data is missing at 24-weeks, then appendix tables will use complete case data while manuscript tables 3 and 4 will use multiply-imputed data with this additional table included:

eTable 10. Analysis results using multiply-imputed data to assess sensitivity to missingness not at random (MNAR) for primary outcomes.

Please see Section 3.1 for Figure 1. Flow of participants through the trial.

Table 1. Baseline characteristics of participants, by treatment group, reported as mean (standard deviation) unless otherwise stated.

	Control N=xx	Intervention N=xx
Age (years)		
Sex, n (%)		
Male		
Female		
Gender, n (%)		
Man or male		
Woman or female		
Non-binary		
Prefer not to answer		
Weight (kg), median (IQR)		
Height (m)		
Body mass index (kg/m^2), median (IQR)		
Ethnicity, n (%)		
Australian/New Zealander		
European		
Other[a]		
Geographical location, n (%)[b]		
Major cities		
Inner regional		
Outer regional/Remote/Very remote		
Education level, n (%)		
Did not complete primary school		
Primary school		
Secondary/high school		
Trade or trade certificate		
University or tertiary institute		
Higher university degree		
Don't know/unsure		
Currently in paid employment, n (%)		
Bilateral knee symptoms, n (%)		
Hip symptom duration (years), median (IQR)		
Financial situation, n (%)		
Find it a strain to get by from week to week		
Have to be careful with money		
Able to manage without much difficulty		
Quite comfortably off		
Very comfortably off		
Prefer not to answer		
Expectation of treatment outcome, n (%)		
No effect at all		
Minimal improvement		
Moderate improvement		
Large improvement		
Complete recovery		
Comorbidities, n (%)[c]		
≥1 comorbid condition		
Heart disease		
High blood pressure		
Lung disease		
Diabetes		

Ulcer or stomach disease	
Kidney disease	
Liver disease	
Anaemia or other blood disease	
Cancer	
Depression	
Back pain	
Other	
Current oral pain medication use, n (%)[d]	
≥1 medication used	
Non-steroidal anti-inflammatories	
Analgesia (paracetamol combinations)	
Oral corticosteroids	
Oral opioids	
Co-interventions, n (%)[e]	
≥1 co-intervention used	
Massage	
Manual therapy	
Walking stick/gait aid	
Ultrasound	
Low level laser therapy	
Transcutaneous Electrical Nerve Stimulation	
Orthotics	
Knee braces	
Heat/cold therapy	
Land-based exercises	
Injections	
Hydrotherapy	
Acupuncture	
Arthroscopic surgery	
High tibial osteotomy	
Ligament reconstructive surgery	
Knee joint replacement surgery	

Data are presented as mean (SD) or median (IQR) for continuous measures, and n (%) for categorical measures.
SD=standard deviation; IQR=interquartile range.
[a]Includes Aboriginal and Torres Strait Islander, Asian, North African & Middle Eastern, North American, South American, Sub-Saharan African and Other Oceanian.
[b]Based on residential postcode, in accordance with Australian Statistical Geography Standard.
[c]Comorbid conditions assessed using the Self-Administered Comorbidity Questionnaire.
[d]Defined as used at least once per week in the prior month (4 weeks) for knee pain.
[e]Defined as used at least once in the prior month for knee pain.

Table 2: Continuous outcome measures across time, by treatment group[a].

	Baseline		24 weeks	
	Control (n=xx)	Intervention (n=xx)	Control (n=xx)[b]	Intervention (n=xx)[c]
Primary outcomes				
Knee pain severity during walking (NRS)[d]				
Physical function (WOMAC)				
Secondary outcomes				
Knee dysfunction and Osteoarthritis Outcome Score (KOOS)[e]				
Function in sport and recreation				
Knee-related quality of life				
Pain self-efficacy (ASES pain subscale)				
Self-Efficacy for Exercise scale (SEE)				
Brief Fear of Movement Scale for Osteoarthritis (BFMS)				
Physical Activity Scale for the Elderly (PASE)				
Osteoarthritis Knowledge Scale (OAKS)				
Brief Illness Perceptions Questionnaire (B-IPQ)				
Exercise Adherence Rating Scale (EARS)	NA	NA		

NRS=numerical rating scale (range 0-10; higher scores indicate worse pain); WOMAC=Western Ontario and McMaster Universities Osteoarthritis Index physical function subscale (17 questions, range 0-68; higher scores indicate worse function); KOOS=Knee dysfunction and Osteoarthritis Outcome Score, (range 0-100; higher scores indicate less pain/better function/quality of life); ASES= Arthritis Self Efficacy Scale pain subscale (range 1-10; higher scores represent greater pain self-efficacy); SEE= Self-Efficacy for Exercise scale (range 0-90; higher scores indicate greater self-efficacy); BFMS= Brief Fear of Movement Scale for Osteoarthritis (range 6-24; higher scores represent more fear); PASE= Physical Activity scale for the Elderly (range 0-400+; higher scores indicate greater levels of physical activity); OAKS=Osteoarthritis Knowledge Scale (range 11-55; higher scores indicate more accurate knowledge about osteoarthritis); B-IPQ=Brief Illness Perceptions Questionnaire (range 0-80, higher indicates more threatening view of osteoarthritis); EARS=Exercise Adherence Rating Scale (range 0-24, higher scores indicate better adherence); NA=not applicable.

[a]Data presented are complete cases and summarized as mean (standard deviation).

[b]Control: xx outcome n=xx.

[c]Intervention: xx outcome n=xx.

[d]Measured on an 11-point numerical rating scale (NRS) for average knee pain severity during walking in the past week. Score range is 0 (no pain) to 10 (worst pain possible); higher score indicates worse pain.

[e]The Knee dysfunction and Osteoarthritis Outcome Score (KOOS) is a knee-specific questionnaire with different subscales, function in sport and recreation (5 items) and knee-related quality of life (4 items). Total subscale scores range from 0 to 100, with 0 indicating extreme problems and 100, no problems.

Table 3: Change in continuous outcomes within and between groups.

	Mean (SD) change within groups[a] Baseline — 24-weeks Control (n=xx)[b]	Intervention (n=xx)[c]	Difference at 24-weeks between groups Intervention — Control Mean (95% CI)[d]	P-value[d]
Primary outcomes				
Knee pain severity during walking (NRS)[e]				
Physical function (WOMAC)[e]				
Secondary outcomes				
Knee dysfunction and Osteoarthritis Outcome Score (KOOS)[f]				
Function in sport and recreation				
Knee-related quality of life				
Pain self-efficacy (ASES pain subscale)[f]				
Self-Efficacy for Exercise scale (SEE)[f]				
Brief Fear of Movement Scale for Osteoarthritis (BFMS)[e]				
Physical Activity Scale for the Elderly (PASE)[f]				
Osteoarthritis Knowledge Scale (OAKS)[f]				
Brief Illness Perceptions Questionnaire (B-IPQ)[e]				
Exercise Adherence Rating Scale (EARS)[f]				

NRS=numerical rating scale (range 0-10; higher scores indicate worse pain); WOMAC=Western Ontario and McMaster Universities Osteoarthritis Index physical function subscale (17 questions, range 0-68; higher scores indicate worse function); KOOS=Knee dysfunction and Osteoarthritis Outcome Score, (range 0-100; higher scores indicate less pain/better function/quality of life); ASES= Arthritis Self Efficacy Scale pain subscale (range 1-10; higher scores represent greater pain self-efficacy); SEE= Self-Efficacy for Exercise scale (range 0-90; higher scores indicate greater self-efficacy); BFMS= Brief Fear of Movement Scale for Osteoarthritis (range 6-24; higher scores represent more fear); PASE= Physical Activity scale for the Elderly (range 0-400+; higher scores indicate greater levels of physical activity); OAKS=Osteoarthritis Knowledge Scale (range 11-55; higher scores indicate more accurate knowledge about osteoarthritis); B-IPQ=Brief Illness Perceptions Questionnaire (range 0-80, higher indicates more threatening view of osteoarthritis); EARS=Exercise Adherence Rating Scale (range 0-24, higher scores indicate better adherence).

[a]Within group changes presented are complete cases and summarized as mean (standard deviation). For EARS, where there are no baseline scores, 24-week scores are presented.

[b]Control: Baseline to 24-week correlations:

[c]Intervention: Baseline to 24-week correlations:

[d]Multiplicity adjusted for two primary outcomes; unadjusted for multiplicity for secondary outcomes.
[e]For change within groups, positive changes indicate improvement. For EARS, positive scores indicate better adherence. For difference between groups, negative differences favour the intervention.
[f]For change within groups, negative changes indicate improvement. For difference between groups, positive differences favour the intervention.

Table 4: Binary and ordinal secondary outcomes.

	Baseline Control n/Total (%)	Intervention n/Total (%)	24-weeks Control n/Total (%)	Intervention n/Total (%)	Relative risk (95% CI)[a]	P-value	Risk difference (95% CI)[a]	P-value
Belief in the inevitability of needing knee joint replacement surgery[b]								
≥1 oral pain medication used[c]								
Improved global rating of change in the knee overall[d]	NA	NA						
Satisfaction with treatment[e]	NA	NA						
Strengthening exercises performed as prescribed[f]	NA	NA						
Uptake of additional physical activity[g]	NA	NA						
Achieved MCID in walking pain[h]	NA	NA						
Achieved MCID in function[i]	NA	NA						
					Odds ratio (95% CI)	**P-value**	**Relative risk ratio (95%**	**P-value**
Weight loss efforts[j]								
I have not thought about making efforts to lose weight/manage my weight	NA	NA						
I have thought about trying to lose weight/manage my weight but have not made any efforts	NA	NA						
I have made some small efforts to lose weight/manage my weight	NA	NA						
I have made a lot of effort to lose weight/manage my weight	NA	NA						

CI=confidence interval; NA=not applicable; MCID=minimum clinically important difference; NRS=numerical rating scale (range 0-10; higher scores indicate worse pain); WOMAC=Western Ontario and McMaster Universities Osteoarthritis Index physical function subscale (17 questions, range 0-68; higher scores indicate worse function).

[a]Relative risks >1 and risk differences >0 favour the Intervention. Complete case data used.

[b]Participants asked: 'I believe that I will need a knee joint replacement at some point', with response options: true, unsure, false. Responses will be dichotomised into 'true' and 'false + unsure' (reference category).

[c]Self-report use of at least 1 oral pain medication, defined as one or more of oral non-steroidal anti-inflammatory drugs and/or analgesics (paracetamol combinations) and/or oral glucocorticoids and/or oral opioids taken at least once a week in the prior month (4 weeks) for knee pain.

[d]Global improvement in overall change in knee condition rated using 7-point scale with terminal descriptors of 'much worse' to 'much better', with participants indicating 'moderately better' or 'much better' classified as 'improved' and all others as 'not improved' (reference category).

[e]Scored on a 7-point Likert scale with terminal descriptors of 'extremely unsatisfied' to 'extremely satisfied'. Participants indicating 'moderately satisfied' or 'extremely satisfied' classified as 'satisfied'. All other categories classified as 'not satisfied' (reference category).

[f]Participants asked 'In the past two weeks, how many days did you perform the strengthening exercise program your physiotherapist prescribed for your knee problem?' Options, which ranged from '0 days' to '14 days', were dichotomised into 'less than 6 days' (reference category) versus '6 to 14 days'.

[g]Participants asked to complete the sentence: 'Apart from the exercises provided by my physiotherapist for this study, in the last 24 WEEKS, my physical activity levels have...' with response options: Decreased significantly, Decreased slightly, Remained the same, Increased slightly, and Increased significantly. Participants selecting 'Increased slightly' and 'Increased significantly' will be classified as having increased physical activity levels. Other categories will be classified as 'not increased' (reference category).

[h]Participants achieving a pain reduction greater than or equal to the MCID of 1.8 NRS points classified as having achieved a clinically relevant pain reduction.

[i]Participants achieving an improvement in function greater than or equal to the MCID of 6 WOMAC points classified as having achieved a clinically relevant function improvement.

[j]Participants asked 'Over the past 24 WEEKS have you made any new efforts to lose weight or manage your weight (for example, changed your diet)?' Ordinal logistic regression model fitted as proportional odds could be assumed. Odds ratios < 1 favour the Intervention. OR Multinomial regression model fitted as proportional odds could not be assumed. Relative risk ratios < 1 favour the Intervention.

eTable 5: Process measures.

	Control	Intervention
8 weeks		
Physiotherapy sessions attended, n/Total (%)[a]		
0		
1		
2		
Satisfied with physiotherapist provided OA information/education, n/Total (%)[b]		
E-learning course prescribed during consult, n/Total (%)[c]	NA	
E-learning course access provided, n/Total (%)[c,d]	NA	
E-learning course program completion, n/Total (%)[c]		
1. Module/week one, 'Learning about osteoarthritis'	NA	
2. Module/week two, 'Physical activity and exercise for osteoarthritis'	NA	
3. Module/week three, 'Body weight and osteoarthritis'	NA	
4. Module/week four, 'Additional management strategies and making a plan'	NA	
Perceived usefulness of E-learning course modules for OA self-management, n/Total (%)[c,e]		
1. Module/week one, 'Learning about osteoarthritis'	NA	
2. Module/week two, 'Physical activity and exercise for osteoarthritis'	NA	
3. Module/week three, 'Body weight and osteoarthritis'	NA	
4. Module/week four, 'Additional management strategies and making a plan'	NA	
5. Course overall	NA	
24 weeks		
Accessed the online course since finishing appointments with the physiotherapist, n/Total (%)	NA	

NA=not applicable; OA=osteoarthritis.

[a]Extracted from the physiotherapy consultation notes when provided on completion of each participants physiotherapy treatment.

[b]Participants were asked 'Thinking beyond the exercises your physiotherapist prescribed you, how satisfied are you with the education information your physiotherapist provided you about osteoarthritis and other management options?' Scored on a 7-point Likert scale with response options from 'extremely satisfied' to 'extremely unsatisfied'. Participants indicating they were 'moderately satisfied' or 'extremely satisfied' were classified as 'satisfied'. Other responses were classified as 'not satisfied'.

[c]Participant report.

[d]Note: N=1 participant reported not receiving the email that the physiotherapist had evidence of sending.

[e]Participants asked how useful each module/week was and how useful the course was overall. Scored on a 4-point Likert scale with response options 'not at all useful', 'slightly useful', 'moderately useful' and 'extremely useful', dichotomised into 'useful' (slightly, moderately, extremely) and 'not useful' (not at all useful): 'useful' presented.

eTable 6. Adverse events and co-interventions at 24 weeks.

	Control	Intervention
Adverse events, n/Total (%)[a]		
≥1 non-serious related adverse event		
Back pain		
Knee pain		
Pelvic pain		
Ceased treatment participation due to a related/possibly related adverse event		
Ceased trial participation due to a related/possibly related adverse event		
≥1 serious related adverse event[b]		
Current oral pain medication use, n/Total (%)[c]		
≥1 oral pain medication used		
Non-steroidal anti-inflammatories		
Analgesia (paracetamol combinations)		
Oral corticosteroids		
Oral opioids		
Other co-interventions, n/Total (%)[d]		
≥1 co-intervention used		
Massage		
Manual therapy		
Walking stick/gait aid		
Ultrasound		
Low level laser therapy		
Transcutaneous Electrical Nerve Stimulation		
Orthotics		
Knee braces		
Heat/cold therapy		
Land-based exercises		
Injections		
Hydrotherapy		
Acupuncture		
Arthroscopic surgery		
High tibial osteotomy		
Ligament reconstructive surgery		

Knee joint replacement surgery

NOTE: numbers of specific adverse events may exceed the number of participants reporting ANY event as it was possible for participants to report more than one type of adverse event. These adverse events can be considered intercurrent events in the present trial.

[a]Related adverse events are defined as 'any problem experienced in the study knee or elsewhere in the body deemed to be a result of participating in the trial and at least one of i) caused negative/adverse symptoms/effects for two days or more, and/or ii) resulted in the participant seeking treatment or taking medication'.

[b]Serious adverse events defined as any untoward medical occurrence that i) results in death; ii) is life-threatening; iii) requires hospitalisation or prolongation of existing inpatient hospitalisation; iv) results in persistent or significant disability or incapacity; v) is a congenital anomaly or birth defect, or; vi) any other important medical condition which, although not included in the above, may require medical or surgical intervention to prevent one of the outcomes listed.

[c]Self-reported use at least once per week in the prior month (4 weeks) for knee pain for each medication with '≥1 oral pain medication used' defined as one or more of oral non-steroidal anti-inflammatory drugs and/or analgesics (paracetamol combinations) and/or oral glucocorticoids and/or oral opioids taken at least once a week in the prior month (4 weeks) for knee pain.

[d]Self-reported use at least once in the prior month for knee pain.

eTable 7: Moderation of the effect of the e-learning course on the primary outcomes at 24 weeks by pre-specified moderators.

Primary outcome	Potential moderator	Moderator coefficient[a] for the Control Mean (95% CI)	Moderator coefficient[a] for the Intervention Mean (95% CI)	Interaction between moderator and group Difference in coefficients[b] Intervention — Control Mean (95% CI) [n=xx]	Interaction P-value
Knee pain severity during walking (NRS)					
	Pain self-efficacy (ASES pain subscale)				
	Brief Fear of Movement Scale for Osteoarthritis (BFMS)				
	Osteoarthritis Knowledge Scale (OAKS)				
	Brief Illness Perceptions Questionnaire (B-IPQ)				
Physical function (WOMAC)					
	Pain self-efficacy (ASES pain subscale)				
	Brief Fear of Movement Scale for Osteoarthritis (BFMS)				
	Osteoarthritis Knowledge Scale (OAKS)				
	Brief Illness Perceptions Questionnaire (B-IPQ)				

CI = confidence interval; NRS=numerical rating scale (range 0-10; higher scores indicate worse pain); WOMAC=Western Ontario and McMaster Universities Osteoarthritis Index physical function subscale (17 questions, range 0-68; higher scores indicate worse function); ASES= Arthritis Self Efficacy Scale pain subscale (range 1-10; higher scores represent greater pain self-efficacy); BFMS= Brief Fear of Movement Scale for Osteoarthritis (range 6-24; higher scores represent more fear); OAKS=Osteoarthritis Knowledge Scale (range 11-55; higher scores indicate more accurate knowledge about osteoarthritis); B-IPQ=Brief Illness Perceptions Questionnaire (range 0-80, higher scores indicate a more threatening view of osteoarthritis).

[a]Moderator coefficient: the effect on each primary outcome at 24 weeks for a 1-unit increase in the relevant potential moderator (a higher score) in each of the groups, adjusted for the outcome at baseline and the stratifying variable of physiotherapist. Negative effects indicate improvement in the relevant primary outcome with 1-unit increases in the relevant potential moderator for the relevant group.

[b]For difference in coefficients, negative differences favour the intervention.

eTable 8. Baseline characteristics and baseline levels of outcomes of participants who provided both primary outcomes at 24-weeks and those participants who did not, reported as mean (standard deviation) unless otherwise stated.

	One or both incomplete N=xx	Both complete N=xx
Group, n (%)		
Control		
Intervention		
Age (years)		
Sex, n (%)		
Male		
Female		
Gender, n (%)		
Man or male		
Woman or female		
Non-binary		
Prefer not to answer		
Weight (kg), median (IQR)		
Height (m)		
Body mass index (kg/m^2), median (IQR)		
Ethnicity, n (%)		
Australian/New Zealander		
European		
Other[a]		
Geographical location, n (%)[b]		
Major cities		
Inner regional		
Outer regional/Remote/Very remote		
Education level, n (%)		
Secondary/high school		
Trade or trade certificate		
University or tertiary institute		
Higher university degree		
Don't know/unsure		
Currently in paid employment, n (%)		
Bilateral knee symptoms, n (%)		
Hip symptom duration (years), median (IQR)		
Financial situation, n (%)		
Find it a strain to get by from week to week		
Have to be careful with money		
Able to manage without much difficulty		
Quite comfortably off		
Very comfortably off		
Prefer not to answer		
Expectation of treatment outcome, n (%)		
No effect at all		
Minimal improvement		
Moderate improvement		
Large improvement		
Complete recovery		

Comorbidities, n (%)[c]
≥1 comorbid condition
Heart disease
High blood pressure
Lung disease
Diabetes
Ulcer or stomach disease
Kidney disease
Liver disease
Anaemia or other blood disease
Cancer
Depression
Back pain
Other
Current oral pain medication use, n (%)[d]
≥1 medication used
Non-steroidal anti-inflammatories
Analgesia (paracetamol combinations)
Oral corticosteroids
Oral opioids
Co-interventions, n (%)[e]
≥1 co-intervention used
Massage
Manual therapy
Walking stick/gait aid
Ultrasound
Low level laser therapy
Transcutaneous Electrical Nerve Stimulation
Orthotics
Knee braces
Heat/cold therapy
Land-based exercises
Injections
Hydrotherapy
Acupuncture
Arthroscopic surgery
High tibial osteotomy
Ligament reconstructive surgery
Knee joint replacement surgery
Knee pain severity during walking (NRS)
Physical function (WOMAC)
Knee dysfunction and Osteoarthritis Outcome Score (KOOS)
Function in sport and recreation
Knee-related quality of life
Pain self-efficacy (ASES pain subscale)
Self-Efficacy for Exercise scale (SEE)
Brief Fear of Movement Scale for Osteoarthritis (BFMS)
Physical Activity Scale for the Elderly (PASE)
Osteoarthritis Knowledge Scale (OAKS)

Brief Illness Perceptions Questionnaire (B-IPQ)

IQR=interquartile range; NRS=numerical rating scale (range 0-10; higher scores indicate worse pain); WOMAC=Western Ontario and McMaster Universities Osteoarthritis Index physical function subscale (17 questions, range 0-68; higher scores indicate worse function); KOOS=Knee dysfunction and Osteoarthritis Outcome Score, (range 0-100; higher scores indicate less pain/better function/quality of life); ASES= Arthritis Self Efficacy Scale pain subscale (range 1-10; higher scores represent greater pain self-efficacy); SEE= Self-Efficacy for Exercise scale (range 0-90; higher scores indicate greater self-efficacy); BFMS= Brief Fear of Movement Scale for Osteoarthritis (range 6-24; higher scores represent more fear); PASE= Physical Activity scale for the Elderly (range 0-400+; higher scores indicate greater levels of physical activity); OAKS=Osteoarthritis Knowledge Scale (range 11-55; higher scores indicate more accurate knowledge about osteoarthritis); B-IPQ=Brief Illness Perceptions Questionnaire (range 0-80, higher indicates more threatening view of osteoarthritis).

[a]Includes Aboriginal and Torres Strait Islander, Asian, North African & Middle Eastern, North American, South American, Sub-Saharan African and Other Oceanian.

[b]Based on residential postcode, in accordance with Australian Statistical Geography Standard.

[c]Comorbid conditions assessed using the Self-Administered Comorbidity Questionnaire.

[d]Defined as used at least once per week in the prior month (4 weeks) for knee pain.

[e]Defined as used at least once in the prior month for knee pain.

eTable 9: Effects of the intervention on the primary outcomes at 24-weeks assuming acceptable adherence (with acceptable adherence defined as completing all 4 modules of the e-learning course).

	Difference between groups[a] Intervention — Control Mean (95% CI)	P-value
Knee pain severity during walking (NRS)[b]		
Physical function (WOMAC)[c]		

CI=confidence interval; NRS=numeric rating scale; WOMAC=Western Ontario and McMaster Universities Osteoarthritis Index; MCID=Minimal clinically important difference.

[a] For difference between groups, negative differences favour the intervention.

[b] NRS, range 0-10 with higher scores indicate worse pain; MCID=1.8 points. N=xxx.

[c] WOMAC, range 0-68 with higher scores indicating more physical dysfunction, MCID=6 points. N=xxx.

eTable 10: Analysis results using multiply-imputed data to assess sensitivity to missingness not at random (MNAR) for primary outcomes.

Primary outcomes	Delta-adjustment	Difference in change between groups[a] Intervention vs Control Mean (95% CI)	P-value
Knee pain severity during walking (NRS)[b]			
	Imputed Minus 1.5 SD		
	Imputed Minus 1 SD		
	Imputed		
	Imputed Plus 1 SD		
	Imputed Plus 1.5 SD		
Physical function (WOMAC)[b]			
	Imputed Minus 1.5 SD		
	Imputed Minus 1 SD		
	Imputed		
	Imputed Plus 1 SD		
	Imputed Plus 1.5 SD		

CI = confidence interval; NRS=numerical rating scale (0-10; higher scores indicate worse pain); WOMAC=Western Ontario and McMaster Universities Osteoarthritis Index physical function subscale (17 questions, range 0-68; higher scores indicate worse function); SD = standard deviation.

[a]Mean (95% CI) difference in change scores between groups, adjusted for the outcome at baseline, estimated using separate models for each outcome and multiply imputed data. Missing data were multiply imputed according to treatment group using chained equations. Imputation models for outcomes included both primary outcomes at both baseline and post-intervention timepoints, along with age, sex, body mass index, ethnicity, geographical location, education level, employment status, comorbidities, laterality and duration of knee symptoms, financial situation and expectation of treatment outcome. A total of x imputations were used, as approximately x% of the participants had missing data in at least one of the outcomes included in the imputation model. A delta-adjustment to the imputed values was added before obtaining the multiple imputation estimate, confidence interval and P value. The adjustments were assumed as a shift of –1.5 SD, a shift of –1 SD, no shift to the imputed values, a shift of +1 SD, and a shift of +1.5 SD for each outcome, with a negative (positive) shift representing a poorer (better) score for those with missing scores. Adjusted two-sided 95% confidence intervals and p-values for the primary outcomes are presented. Standard deviations used in the delta-adjustment were 2 NRS points and 11 WOMAC points for the respective outcomes.

[b]For difference in change between groups, positive differences favour the Intervention. Multiplicity adjusted 95% confidence intervals and p-values presented.

14 Appendix A. PASE Scoring.

COMPUTER CODE FOR PASE SCORING

The following code may be used to calculate PASE scores by computer. Questionnaire items are designated by "Q" followed by the PASE item number, e.g., Q9C refers to questionnaire item 9C (outdoor gardening).

```
RECODE Q2, Q3, Q4, Q5, Q6 (0=0)(1 =1.5)(2=3.5)(3=6)(ELSE = -1)
RECODE Q2A, Q3B, Q4B, Q5B, Q6B (1=.5)(2=1.5)(3=3)(4=5)
COMPUTE Q2 = Q2 * Q2A/7.
COMPUTE Q3 = Q3 * Q3B/7.
COMPUTE Q4 = Q4 * Q4B/7.
COMPUTE Q5 = Q5 * Q5B/7.
COMPUTE Q6 = Q6 * Q6B/7.
RECODE Q7, Q8, Q9A, Q9B, Q9C, Q9D (1=0)(2=1)(ELSE = -1)
RECODE Q10 (1=0)
IF (Q10B = 1) Q10 = 0.
IF (Q10B ≥ 2) Q10 = Q10A/7.
COMPUTE PASE = 20*Q2 + 21 *Q3 + 23*(Q4 + Q5) + 30*Q6 +
25*(Q7 + Q8) + 30*Q9A + 36*Q9B + 20*Q9C + 35*Q9D + 21*Q10.

MISSING VALUE ALL (-1).
```