Trajectories of adherence to home-based exercise programs among people with knee osteoarthritis

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S U M M A R Y

Objective: To investigate the presence of different trajectories of self-reported adherence to home exercise programs among people with knee osteoarthritis (OA), and to compare baseline characteristics across identified groups.

Design: Pooled analysis of data from three randomised controlled trials involving exercise interventions for people aged ≥50 years with clinical knee OA (n = 341). Exercise adherence was self-reported on an 11-point numerical rating scale (NRS; 0 = not at all-10 = completely as instructed). Latent class growth analysis was used to identify distinct trajectories of adherence, at intervals from 12 to 78 weeks from baseline. Baseline characteristics of these groups were compared using chi-squared tests, one-way analysis of variance (ANOVA) and Kruskal Wallis tests where appropriate.

Results: Three distinct adherence trajectories were identified: a “Rapidly declining adherence” group (n = 157, 47.4%) whose adherence was 7.7 ± 1.6 (/10) at 12 weeks, declined to 4.2 ± 2.2 by 22 weeks and remained low thereafter; a “Gradually declining adherence” group (n = 153, 45.1%) whose adherence declined from 8.5 ± 1.5 to 7.8 ± 1.5 over the same period, and continued to decline slowly, and a “Low adherence” group (n = 21, 6.3%) whose adherence was 2.2 ± 1.4 at 12 weeks and remained low. At baseline the “Rapidly declining adherence” group reported significantly lower Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain (mean difference [95% Confidence Interval (CI)] −0.8 (−1.4, −0.2)) and better WOMAC function compared to the “Gradually declining adherence” group (−3.1 (−5.2, −1.1)).

Conclusion: Three trajectories of self-reported adherence to home exercises were found among people with knee OA. Findings highlight the need for close monitoring of adherence from initiation of a home exercise program in order to identify and intervene when low or rapidly declining adherence is identified.

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Introduction

Knee osteoarthritis (OA) is an increasingly common and disabling problem in older adults worldwide. Exercise is considered the cornerstone of non-surgical management of knee OA and is recommended in all current clinical guidelines. These recommendations are based upon high quality evidence demonstrating the effectiveness of exercise for improving function and decreasing pain. Due to the chronic nature of knee OA, and given financial constraints, home-based exercise programs are commonly used. The most recent Cochrane review of exercise for knee OA found that home-based programs provided moderate beneficial treatment effects that did not differ significantly from those reported with supervised individual and class-based exercise programs. Optimizing outcomes of home exercise programs is thus essential in the successful long-term management of knee OA.

Although exercise provides immediate and short-term clinically worthwhile benefits for people with knee OA, these benefits have been found to decline over time and disappear in the long-term. Adherence to exercise programs as prescribed has been associated with greater improvements in both physical performance and self-reported pain and function among people with hip and knee
OA8–12. Furthermore, an international expert multidisciplinary panel suggested that long-term adherence to an exercise program is the key predictor of the long-term success of that program13. However, a number of clinical trials examining exercise interventions for people with knee OA have reported that adherence to home-based exercise programs varied significantly between participants, was poor overall, and declined over time8,9,14–18. Given that adherence to exercise among people with knee OA is influenced by a vast array of factors19,20, it is unsurprising that exercise adherence varies across individuals. To date, studies have not examined the presence of common trajectories of adherence across cohorts of people with knee OA undertaking home exercise programs.

Identifying distinct exercise adherence trajectories among people with knee OA allows a better understanding of how adherence to exercise typically changes over time, and may facilitate identification of individuals most at risk of declining exercise adherence, who may benefit from interventions specifically designed to boost exercise adherence at particular time points. The aim of this study was to investigate the presence of groups showing different trajectories of self-reported adherence to home exercise programs among people with knee OA, and to compare baseline characteristics across identified groups.

Methods

Study overview

We performed a pooled analysis of data previously collected in three randomized controlled trials (RCTs) investigating exercise interventions for painful knee OA14–16. Detailed protocols and results of the studies have been previously published14–16,21–23. Data were excluded from any study arms that did not include exercise.

Participants

Participants (n = 341) in the three RCTs were recruited from the community via advertisements in print, radio and digital media, in metropolitan Melbourne and across Australia. Similar recruitment strategies were used in all included studies. Approval was obtained from The University of Melbourne’s Human Research Ethics Committee for each study, and all participants provided written informed consent.

Common inclusion criteria for all studies were: (1) aged ≥50 years; (2) fulfilling the criteria of knee OA according to the American College of Rheumatology24; knee pain on most days of the past month; (3) knee pain ≥3 months duration; and (4) overall average knee pain in the last week ≥four on an 11 point numeric rating scale (NRS).

Exclusion criteria for all studies were 1) previous knee arthroplasty or on waiting list; 2) other knee surgery or corticosteroid injection into the knee in the past 6 months; 3) physiotherapy for the knee in the past 6 months; 4) systemic arthritic conditions; 5) any other condition that affected the lower limbs and/or limited the ability to exercise safely (such as polio, neuropathy, peripheral nerve disease, stroke or Parkinson’s disease); or 6) not fluent in written and spoken English.

Exercise interventions

Table 1 outlines the content and duration of the trial intervention arms from which data was pooled. All participants in the included exercise intervention arms of the studies were prescribed 4–6 lower limb strengthening exercises by a physiotherapist from the same pre-defined list of exercises, to be completed unsupervised at home three times per week.

Measures

Adherence to home exercise program

Participants in all studies self-rated their adherence to the prescribed home exercise program over the previous 3 months (12 weeks) using an 11-point NRS (0 = not at all, 10 = completely as instructed). Such scales have been found to have acceptable reliability (intra-class correlation coefficient = 0.77) in assessing exercise adherence among other musculoskeletal populations25. Exercise adherence measurement time points are outlined in Table I.

Demographic characteristics

Demographic information was collected at baseline, including age, sex, height and weight. Body mass index (BMI) was calculated.

Outcome measures

Baseline scores of the following outcome measures were used in analyses.

Pain and physical function

Pain and physical function were measured on the respective subscales of the WOMAC (Likert version 3.1)26, which is a disease-specific self-reported questionnaire. The pain subscale has five items, each answered on a five point Likert scale (0 = no pain, 4 = extreme pain) giving a total score out of 20 (maximum pain). The physical function subscale has 17 items, each answered on a five point Likert scale (0 = no dysfunction, 4 = extreme dysfunction) giving a total score out of 68 (maximum dysfunction).

Health-related quality of life

The Assessment of Quality of Life instrument version 2 (AQoL II) was used to measure health-related quality of life27. The AQoL II consists of 20 questions covering six dimensions of health-related quality of life including independent living, social relationships, coping, pain and psychological wellbeing. Scores range from –0.04 (worst possible health-related quality of life) to 1.00 (full health-related quality of life).

Self-efficacy

Self-efficacy was evaluated using the Arthritis Self-Efficacy Scale. This scale assesses confidence for managing pain (five questions); physical function (nine questions) and other arthritis symptoms (six questions). Each question is rated on a 10-point NRS (1 = very uncertain, 10 = very certain) with total weighted scores ranging from 3 (lowest level of self-efficacy) to 30 (highest level).

Statistical analysis

All analyses were conducted in R (R foundation, Vienna, Austria). To identify groups of participants with distinct trajectories of home exercise adherence, we used latent class growth analysis. Conventional growth modelling assumes that a single trajectory can adequately describe the adherence pattern of the entire sample, however the latent class method allows for different adherence trajectories: i.e., for participants’ adherence to vary around different means over time28. Models were fitted to the longitudinal adherence data using the lcmm package29 in R. The optimal model was identified by fitting a single-group model to the data and then successively increasing the number of groups until model
estimation failed (i.e., parameters of the model could not be estimated). The model with the lowest Bayesian information criterion (BIC) was selected as the optimal model. The BIC is a measure of model fit, with lower BIC values indicating better model fit. A categorical term to identify the parent RCT and linear and quadratic terms for week (adherence measurement time point) were included in the models for adherence. Quadratic terms for time were included to allow for potential non-linearity in the average trajectory of adherence over time. All models included a random intercept for participant and a random slope for week.

After the model with the optimal number of groups was identified, chi-squared tests were used to test for differences in baseline characteristics between participants assigned to each adherence group with respect to categorical variables whereas one-way analysis of variance (ANOVA) was used for continuous variables which were approximately normally distributed and the Kruskal Wallis test for continuous variables that did not appear to be normally distributed. Mean between-group differences and 95% confidence intervals were calculated for continuous variables using t-distributions.

Results

Study population

Self-reported adherence data were analysed for 341 participants, 331 of whom had complete data for the characteristics included in the adherence model. These participants were enrolled in studies that measured adherence at three or more time points, ranging from 12 to 78 weeks following allocation to an exercise intervention. Baseline characteristics of included participants are shown in Table II. Participants had a mean standard deviation (SD) age of 62.7 (7.5) years, the majority were female (57%) and the group had a mean BMI of 31.4 ± 6.7. Participants reported moderate pain (8.7 ± 2.7) and functional impairment (32.1 ± 9.3) measured on the WOMAC subscales.

Identification of adherence trajectories

Models with one, two, three and four groups were fitted: estimation of a model with five groups failed. Table III contains the BICs and percentages of participants assigned to each group for each model. The model with three groups was the optimal model with the lowest BIC. The probability that each participant belonged to each group was calculated, and participants were assigned to the group to which they had the highest probability of belonging. For the three group model, 83% of participants had a probability greater than 80% of belonging to the group to which they were assigned, indicating that most participants clearly belong to one of the three adherence groups.

Figure 1 displays all participants’ adherence data with a smoothed adherence trajectory (constructed using loess) and 95% confidence intervals across all time points for the single and three group models. Table IV contains the corresponding mean ± standard deviation for self-rated adherence at all time points for both models. In the single group model, mean adherence was 7.8 ± 2.1 (out of 10) at 12 weeks declining to 6.0 ± 2.7 at 22 weeks, followed by further gradual decline to 3.5 ± 3.2 at 78 weeks. The three group model showed that participants have been split into three distinct groups based on adherence: one whose
adherence rapidly declined and then remained poor (Group 1 termed “Rapidly declining adherence”, n = 157, 47.4% of the cohort), a second group whose adherence started high and declined gradually over time (Group 2 termed “Gradually declining adherence”, n = 153, 45.1% of the cohort), and a small third group whose adherence was poor throughout (Group 3 termed “Low adherence”, n = 21, 6.3% of the cohort). Mean adherence was higher in the “Gradually declining adherence” group compared to the “Rapidly declining adherence” and “Low adherence” groups at all time points. Notably, adherence in the “Rapidly declining adherence” group fell sharply from 7.7 ± 1.6 at 12 weeks (“Gradually declining adherence” group = 8.5 ± 1.5) to 4.2 ± 2.2 at 22 weeks (“Gradually declining adherence” group = 7.8 ± 1.5 at 22 weeks). At the longest follow up time point at 78 weeks, mean adherence in the “Rapidly declining adherence” group was 1.8 ± 2.4 and in the “Low adherence” group was 1.4 ± 2.3 compared to 5.5 ± 3.0 in the “Gradually declining adherence” group. The standard deviation around mean adherence increased over time in all groups, suggesting adherence was more variable longer term.

Appendix 1 highlights the adherence trajectories of those participants who had a probability of being in their assigned group of <0.8. For the “Gradually declining adherence” group, participants with probabilities <0.8 tended to have more rapidly declining adherence than others in that group. For the “Rapidly declining” group, those who had probabilities <0.8 of being in that group appeared to be a mix of those with lower levels of adherence and less steep adherence deteriorations.

Figure 2 shows observed and predicted adherence trajectories for the optimal three-group model. Adherence predicted by the model fell within the 95% CIs of observed adherence at all time points for the “Gradually declining adherence” group. For the “Rapidly declining adherence” and “Low adherence” groups, the model overestimated adherence for three of the five time points within the first 36 weeks. However, beyond 36 weeks, the observed and predicted adherence values were well matched for these groups. Probability of trajectory group allocation did not differ between parent studies or by intervention content.

Baseline characteristics of participants in the three adherence trajectory groups

Baseline characteristics of participants in each trajectory group are shown in Table II. There were few characteristics that distinguished between participants belonging to each of the three trajectory groups. At baseline the “Rapidly declining adherence” group reported significantly lower WOMAC pain (mean difference (95% CI) –0.8 (–1.4, –0.2)) and better WOMAC function (–3.1 (–5.2, –1.1)) compared to the “Gradually declining adherence” group. In addition the “Low adherence” group reported borderline significantly poorer self-efficacy in managing their OA symptoms compared to the “Rapidly declining adherence” group (mean difference (95%CI) 1.9 (0.0, 3.8)).

### Table II

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All participants (n = 331)</th>
<th>Group 1 Rapidly declining adherence (n = 157)</th>
<th>Group 2 Gradually declining adherence (n = 153)</th>
<th>Group 3 Low Adherence (n = 21)</th>
<th>Mean difference between Group 1 and 2</th>
<th>Mean difference between Group 1 and 3</th>
<th>Mean difference between Group 2 and 3</th>
<th>P-value for differences between groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>62.7 ± 7.5</td>
<td>62.2 ± 7.9</td>
<td>62.7 ± 7.0</td>
<td>65.2 ± 7.3</td>
<td>–0.5 (–2.2, 1.1)</td>
<td>–3.0 (–6.6, 0.5)</td>
<td>–2.5 (–6.0, 1.0)</td>
<td>0.21</td>
</tr>
<tr>
<td>Female (%)</td>
<td>189 (57.1)</td>
<td>83 (52.9)</td>
<td>97 (63.4)</td>
<td>9 (42.9)</td>
<td>–0.4 (–1.9, 1.1)</td>
<td>–0.4 (–3.7, 2.8)</td>
<td>0.0 (–3.3, 3.3)</td>
<td>0.84</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>31.4 ± 6.7</td>
<td>31.1 ± 6.3</td>
<td>31.6 ± 7.0</td>
<td>31.6 ± 6.8</td>
<td>9.3 ± 2.4</td>
<td>–0.8 (–1.4, 0.2)</td>
<td>–1.1 (–2.2, 0.1)</td>
<td>0.03 (–1.5, 0.9)</td>
</tr>
<tr>
<td>WOMAC pain subscale (0–20)[1]</td>
<td>32.1 ± 9.3</td>
<td>30.6 ± 8.8</td>
<td>33.7 ± 9.6</td>
<td>31.8 ± 9.7</td>
<td>–3.1 (–5.2, –1.1)</td>
<td>–1.2 (–5.8, 3.3)</td>
<td>1.9 (–2.7, 6.5)</td>
<td>0.012</td>
</tr>
<tr>
<td>WOMAC function subscale (0–68)[1]</td>
<td>0.76 [0.65, 0.83]</td>
<td>0.78 [0.69, 0.83]</td>
<td>0.75 [0.63, 0.81]</td>
<td>0.73 [0.63, 0.79]</td>
<td>0.074</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arthritis self-efficacy scale (3–30)[2]</td>
<td>19.6 ± 4.2</td>
<td>20.1 ± 3.9</td>
<td>19.4 ± 4.3</td>
<td>18.1 ± 4.0</td>
<td>0.7 (–0.2, 1.6)</td>
<td>1.9 (0.0, 3.8)</td>
<td>1.2 (–0.7, 3.2)</td>
<td>0.080</td>
</tr>
<tr>
<td>Intervention content, n (%)</td>
<td>134 (40.5)</td>
<td>58 (36.9)</td>
<td>62 (40.5)</td>
<td>14 (66.7)</td>
<td></td>
<td></td>
<td></td>
<td>0.31</td>
</tr>
<tr>
<td>Exercise alone</td>
<td>68 (20.5)</td>
<td>34 (21.7)</td>
<td>32 (20.9)</td>
<td>2 (9.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise + pain coping skills training</td>
<td>129 (39.0)</td>
<td>65 (41.4)</td>
<td>59 (38.6)</td>
<td>5 (23.8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chi-squared tests were used to test for differences between groups with respect to categorical variables; One-way ANOVA was used for continuous variables, except for AQoL for which the Kruskal Wallis test was applied. Mean group differences and 95% Confidence Intervals were calculated for continuous variables using t-distributions. BMI = Body Mass Index; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index; AQoL II = Assessment of Quality of Life version 2.

1 Lower scores = better.

2 Higher scores = better.

### Table III

<table>
<thead>
<tr>
<th>Number of adherence trajectory groups</th>
<th>Number of adherence trajectory groups</th>
<th>Group n</th>
<th>BIC</th>
<th>Posterior probabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6727.1</td>
<td>331</td>
<td>1.0</td>
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<tr>
<td>2</td>
<td>6646.9</td>
<td>168</td>
<td>0.91</td>
<td>0.91</td>
</tr>
<tr>
<td>3</td>
<td>6631.0</td>
<td>157</td>
<td>0.90</td>
<td>0.93, 0.82</td>
</tr>
<tr>
<td>4</td>
<td>6656.4</td>
<td>123,110,82,16</td>
<td>0.88, 0.83, 0.15, 0.82</td>
<td></td>
</tr>
</tbody>
</table>

BIC = Bayesian information criterion; where the lowest value indicates the best fitting model.

Discussion

To our knowledge this is the first study to explore whether common trajectories of adherence to home exercise programs are present among people with knee OA. We identified three distinct trajectory groups; one group whose adherence was moderate at the earliest time point (12 weeks), declined rapidly over the following 10 weeks and then remained poor; a second group whose
adherence was high at 12 weeks and declined slowly at each time point to 78 weeks, and a third group whose adherence was poor at all time points. Adherence in the “Rapidly declining” and “Low adherence” groups was significantly lower than in the “Gradually declining adherence” group at all time points. Posterior probability of correct group membership for this three group model was high, indicating most participants were correctly classified. Few baseline characteristics distinguished between participants across the three trajectory groups, however the “Rapidly declining adherence” group reported significantly lower WOMAC pain scores and better WOMAC function scores, compared to the “Gradually declining adherence” group.

Self-reported adherence to prescribed home strengthening exercise declined from 12 weeks to 78 weeks across our cohort, however the patterns and magnitude of this decline differed significantly between the trajectory groups. Previous exercise studies for knee OA have also reported a decline in adherence over time, however differences in methods of measurement and reporting preclude accurate comparisons of these findings. Messier and colleagues reported the proportion of scheduled sessions that

<table>
<thead>
<tr>
<th>Week</th>
<th>All participants</th>
<th>Group 1: Rapidly declining adherence</th>
<th>Group 2: Gradually declining adherence</th>
<th>Group 3: Low adherence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Self-rated adherence mean ± SD</td>
<td>n</td>
<td>Self-rated adherence mean ± SD</td>
</tr>
<tr>
<td>12</td>
<td>309</td>
<td>7.8 ± 2.1</td>
<td>144</td>
<td>7.7 ± 1.6</td>
</tr>
<tr>
<td>22</td>
<td>117</td>
<td>6.0 ± 2.7</td>
<td>50</td>
<td>4.2 ± 2.2</td>
</tr>
<tr>
<td>26</td>
<td>193</td>
<td>5.8 ± 2.9</td>
<td>93</td>
<td>4.8 ± 2.5</td>
</tr>
<tr>
<td>32</td>
<td>112</td>
<td>5.1 ± 3.2</td>
<td>49</td>
<td>2.4 ± 1.9</td>
</tr>
<tr>
<td>36</td>
<td>169</td>
<td>4.7 ± 3.3</td>
<td>79</td>
<td>2.4 ± 2.0</td>
</tr>
<tr>
<td>42</td>
<td>114</td>
<td>4.9 ± 3.0</td>
<td>49</td>
<td>2.4 ± 2.1</td>
</tr>
<tr>
<td>52</td>
<td>231</td>
<td>4.4 ± 3.2</td>
<td>106</td>
<td>2.2 ± 2.0</td>
</tr>
<tr>
<td>65</td>
<td>105</td>
<td>3.9 ± 3.2</td>
<td>48</td>
<td>2.1 ± 2.0</td>
</tr>
<tr>
<td>78</td>
<td>123</td>
<td>3.5 ± 3.2</td>
<td>59</td>
<td>2.1 ± 2.5</td>
</tr>
</tbody>
</table>

Exercise adherence was self-rated on an 11-point numerical rating scale (0 = not at all, 10 = completely as instructed). SD = standard deviation.
participants actually completed in a large cohort undertaking exercise. Adherence in the exercise alone group was 70% for the first 6 months and 58% at 18 months. Among a cohort of people with hip or knee OA randomised to behavioural graded therapy or usual exercise therapy, Pisters and colleagues reported 57.8% of the group were adherent to exercises at 3 months, 44.1% at 15 months, and 30.1% at 60 months.

Our data showed statistically significant differences, albeit small in magnitude, in baseline pain and function between the participants in the “Rapidly declining” and “Gradually declining” adherence groups. In addition, a number of trends across baseline characteristics were identified, which approached but did not reach statistical significance, likely due to the small sample size within the “Low adherence” trajectory group. The observed baseline differences in pain and function between the “Rapidly declining adherence” and “Gradually declining adherence” groups, suggest that people who are less impacted by their knee OA may be most likely to rapidly discontinue a home exercise program as prescribed following an intervention period. In contrast, participants in the “Low adherence” group showed trends towards poorer self-efficacy in managing their OA symptoms compared to the “Rapidly declining adherence” group, implying that people who self-report low confidence in managing with their OA may struggle to engage with a home exercise program from the outset. Limited previous research has aimed to identify factors that may predict “poor” or “good” adherence to exercise among people with OA, with mixed and inconclusive findings. Secondary analysis of a large cohort of patients with meniscal tear and OA who had taken part in a randomized trial of exercise found that low income, being of non-white race or male sex, and having no pain with pivoting were predictive of poor adherence in regression models. The authors found no relationship between age, radiographic grade of OA, knee pain, self-reported function, quality of life or functional performance. Schoo and colleagues found that participants who were physically active were more likely to perform their home exercises, whereas those who perceived themselves to be inactive at the time of exercise prescription were less likely to maintain exercise at home. In a systematic review of factors influencing adherence to exercise programs among older adults, better self-rated health, better physical abilities and fewer depressive symptoms were associated with better exercise adherence. It is worth noting however that these studies were methodologically different to ours.

Strengths of our study include the use of latent class growth analysis to explore patterns of self-reported exercise adherence over time. The latent class method allows for different groups of participants to have adherence trajectories that differ over time, rather than previous methods which assume that all participants follow a common trajectory. The three RCTs from which data were pooled had common inclusion criteria, and all participants were prescribed similar home exercises and asked to continue these 3 days per week.

Limitations of the current study should also be highlighted. Recruitment of community volunteers for the RCTs is a potential source of bias. All participants participated in a number of consultations with a clinician followed by a period of independent home exercise. The effect of this contact on adherence cannot be quantified, and the desire to please the clinician/researchers may have contributed to overestimation of adherence during the contact period which may then have dissipated longer term. Adherence was assessed at varying time points in the included studies, resulting in varying numbers of participants at each time point when data were pooled. As such, the same participants did not contribute to the different follow up times. However, the use of latent class analysis does not require that all participants contribute to all time points, so this factor does not detract from the results. While several patient-specific factors were assessed at baseline, other important
potentially explanatory variables were not examined. Outcome expectation is one such factor that has previously been suggested to be important in determining exercise engagement and ongoing adherence. Future studies should explore further the role of outcome expectations and other determinants such as lifestyle factors in determining exercise adherence over time.

The method used to assess exercise adherence in the included studies is also a limitation. Retrospective self-rated adherence, such as the measure utilised in these studies, is a common method used to assess exercise adherence, as there are few other feasible methods available. While evidence exists demonstrating the reliability of such scales, to date, this measure has not been validated, and the lack of standardised methods of measuring exercise adherence has previously been acknowledged as a limitation to advancing research in this field. Recent systematic reviews of measures of self-reported adherence to home exercise programs concluded there is currently no gold standard measure, which is promising for future research in the field. Use of these measures in future trials of exercise will provide important objective measures of adherence. In addition, psychometric evaluation of commonly used self-reported measures of exercise adherence, and development of a validated outcome measure for exercise adherence, should be future research priorities.

Identifying differing adherence trajectory groups among people with knee OA is of significance both for the design of future research studies and in clinical practice. Our findings should alert clinicians and researchers to be aware that not all people with knee OA adhere to the same extent when prescribed a home exercise program. Certain subgroups of people are at greater risk of not adhering to prescribed exercise, and thus will likely fail to achieve maximal benefits from exercise. The small differences in baseline characteristics observed between trajectory groups in our study should discourage clinicians from attempting to predict the likely trajectory of adherence for any individual based on these factors alone. Instead, adherence should be consistently monitored from commencement of an exercise program in order to identify those that show low adherence from the outset, or rapidly declining adherence, in order to intervene with these groups as soon as possible. A range of strategies may be used to try and increase adherence in those patients where adherence is identified as a problem early on or declines rapidly. Our recent systematic review found moderate quality evidence that booster sessions with a physiotherapist assisted people with hip/knee OA to better adhere to therapeutic exercise, and individual trials supported the use of motivational strategies and behavioural graded exercise.

Our study identified three distinct trajectories of adherence to home exercise among people with knee OA. Our results highlight the need for close monitoring of adherence from initiation of a home exercise program in order to identify and intervene with participants following a low or rapidly declining adherence trajectory. Further work is needed to explore whether similar trajectories are present among other cohorts of participants with knee OA undertaking home exercise, the influence of factors other than those examined in this study on adherence trajectories, and whether these trajectories are associated with differences in clinical outcomes over time.

Author contributions

The authors contributed to the manuscript as follows: conception and design: KB, RH, PN, JK; statistical expertise: JK; analysis and interpretation of the data: PN, JK, KB, RH; drafting of the article: PN, KB, RH, JK. Final approval of the article: PN, KB, RH, JK.

Conflict of interest

The authors have no conflicts of interest to declare.

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Appendices

Appendix 1. Individual trajectories of adherence over time for participants with >80% probability of being in the group to which they were assigned for the optimal three group model.
References


