



Physical activity levels after hip and knee joint replacement surgery: an observational study

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Abstract

Usual care after hip or knee joint replacement does not adequately address the problem of low physical activity levels. We aimed to determine whether exercise delivered in a group setting in the early stage of outpatient rehabilitation influenced self-reported physical activity levels after hip or knee joint replacement. A case series of 79 participants referred to a 6-week outpatient orthopaedic exercise group after total hip or knee replacement were evaluated using the International Physical Activity Questionnaire (IPAQ) short form. Physical function was evaluated using Osteoarthritis Research Society International (OARSI) recommended performance-based tests (30 s Chair Stand Test, 40 m Fast Pace Walk Test, Stair Climb Test, Timed Up and Go Test, 6 Minute Walk Test). Measures were assessed at admission, discharge and 6 weeks after group discharge. Non-parametric analysis was conducted for IPAQ scores. Analysis of functional measures was conducted with linear mixed models with time modelled as a repeated measure. Standard multiple regression and correlation analysis were conducted. Fifty-four participants completed the study. Self-reported activity levels improved significantly at program discharge but not at 6-week follow-up. All performance-based measures improved significantly at program discharge. Fast-paced walking and 6 Minute Walk Test measures continued to improve at 6-week follow-up. Group dynamics present in an outpatient rehabilitation exercise program may increase physical activity levels during group participation but not after group cessation. Performance in all functional measures improved at group discharge.

Keywords Exercise · Group · Joint replacement · Osteoarthritis · Physical activity

Introduction

Compared with pre-surgery levels, physical activity does not significantly increase after total hip or knee joint replacement [1–6]. One recent study found physical activity remained low up to 4 years after surgery [7]. This is of concern as most people with lower limb osteoarthritis fail to meet physical

activity guidelines and are at increased risk of cardiovascular disease and all-cause mortality compared to the general population [5, 8–11]. Outpatient rehabilitation after hip or knee joint replacement may provide an optimal environment to deliver an effective intervention to address the problem of low levels of physical activity.

Usual-care rehabilitation after hip or knee joint replacement is provided individually rather than as group-based therapy [12, 13]. However, group-based therapy may have greater potential to influence physical activity levels than individual therapy [14]. Group-based therapy may help develop a sense of unity and cohesion in progression towards a common goal and the supervision component may improve adherence to an exercise program [15, 16]. Additionally, trials conducted after hip and knee joint replacement found that individual therapy offered no advantage compared to group-based therapy when gains in physical function and pain were evaluated [17–23]. Outpatient group-based therapy is more cost-effective than inpatient, individual or supervised home-based therapy [24, 25]. Rehabilitation delivered in the group setting is well

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tolerated after total knee replacement and can reduce pain and increase function [26]. However, the potential for group-based rehabilitation to address the problem of low levels of physical activity after hip or knee joint replacement has not been evaluated.

The primary aim of this study was to determine the effect of group-based therapy participation on self-reported physical activity levels after hip or knee joint replacement. The secondary aim was to determine the effect on functional measures.

Materials and methods

This was a single group, pre-test/post-test study using a prospective observational design. The health service ethics committee approved the study (Eastern Health Human Research Ethics Committee approval number LR111/1314) and written informed consent was obtained from all participants.

The study was conducted at a community rehabilitation centre, located in a large public health network in Melbourne, Australia. Patients were included in the study if they were aged 18 years or more, had recently undergone a total hip or total knee joint replacement, were independently mobile, were classified as weight-bearing as tolerated, met the community rehabilitation admission criteria (the client had undergone a recent functional decline and was willing to participate in outpatient rehabilitation therapy provided by the centre) and were deemed appropriate to attend an exercise group by their treating physiotherapist. Patients were excluded if they were unable to mobilise independently either with or without assistive devices, had hip or knee procedures other than a primary total joint replacement (e.g. revision of a previous joint replacement, hemi-arthroplasty, unicompartamental arthroplasty) or were unable to participate safely in the exercise program due to either cognitive impairment or other serious coexisting health conditions not related to the joint replacement (e.g. uncontrolled serious cardiac disease). All study participants completed the Exercise & Sports Science Australia (ESSA) Adult Pre-Exercise Screening Tool Stage 1 and were deemed medically appropriate to attend the exercise group [27]. The orthopaedic exercise group ran for 60 min and was conducted once per week. Patients were discharged from the orthopaedic exercise group when they had attended six sessions. A ‘rolling group’ format was used, with group sessions containing both new patients and patients who had attended up to six sessions. A typical exercise program is listed in Table 1. The program was circuit-based and included aerobic, strengthening and range of motion exercises, with a focus on functional training.

An experienced community rehabilitation physiotherapist and an allied health assistant supervised the group. Participants were encouraged to increase the intensity and duration of each

Table 1 The standard orthopaedic exercise group routine

Leg strengthening exercises ± cuff leg weights including
Sitting
• Knee extension
• Repeated sit to stand
• Repeated sit to stand on a foam block was used for higher functioning patients
Standing
• Hip abduction
• Hip extension
• Hip flexion
• Semi-squats
• Heel-raises
• Hamstring curls
Dosage
• 1–2 × 10–15 of each exercise
Squats using a fitball placed against the wall or on a bosu ball were prescribed for some higher functioning patients; 1–2 × 10–15
Exercise bike or foot pedals 5–15 min; self-selected comfortable pace
Treadmill or land-based walking program 5–15 min; self-selected comfortable pace
Stair climbing and descent (four steps); 2–5 min
Lunges with foot on a step; 1–2 × 10
Forward stepping and side stepping over hurdles; 2–3 min
Self-assisted knee flexion, which often involved the use of a skateboard; 1–2 × 20
Stretches
• Hamstrings
• Gastrocnemius (standing on a wedge)
Dosage
• 3 × 30 s holds
Higher level participants post knee joint replacement often used a leg press with a resistance appropriate to the individual; 3 × 10–15
Balance exercises involving foam blocks, foam planks, dura discs and rocker boards; 5 min

exercise as the program progressed. All participants received an individualised home exercise program from their treating physiotherapist prior to exercise group commencement. Participants were encouraged to continue with their home exercise program during the group and after discharge.

As part of the community rehabilitation centre’s standard practice, all patients with lower limb joint replacement were offered six hydrotherapy sessions in addition to joint replacement exercise group participation. The time of hydrotherapy session commencement varied between individuals, and depended on community rehabilitation centre hydrotherapy protocols (e.g. patients wait 6 weeks after surgery before hydrotherapy commencement to reduce the risk of wound infection), hydrotherapy class availability and individual patient preferences (e.g. some patients preferred to complete the community rehabilitation centre exercise group before starting hydrotherapy). Study outcomes were assessed in relation to the

completion of the exercise group conducted in the community rehabilitation centre and may have included participants who had not commenced hydrotherapy or were still attending hydrotherapy.

Assessment

The primary outcome of physical activity was evaluated with the International Physical Activity Questionnaire (IPAQ), a self-reported measure that records physical activity time and intensity over the last 7 days [28]. The IPAQ short version was completed at group commencement, upon discharge and at 6-week follow-up. The amount of energy participants expended in metabolic equivalent of task minutes per week (MET-min/week) was calculated according to the IPAQ protocol. One MET is defined as 1 kcal/kg/h (3.5 ml/kg/min) and is approximately equal to the energy cost of sitting quietly [29]. The minimal clinically important difference (MCID) for MET-min/week consumption at group discharge was estimated using 0.5 of the baseline standard deviation, which equated to 705 MET-min/week. [30]. Self-reported physical activity was classified as ‘low’, ‘medium’ or ‘high’ as described by IPAQ protocol (<https://sites.google.com/site/theipaq/scoring-protocol>, accessed August 24, 2018). Secondary outcomes, five performance-based functional measures recommended by Osteoarthritis Research Society International (OARSI) [31], were also evaluated at group commencement, upon discharge and at 6-week follow-up. Secondary outcomes included *The 30 s Chair Stand Test*, which assesses the number of chair stand repetitions that can be completed in 30 s (MCID is 2.6 repetitions [32], normative value is 14 repetitions [33]). The *40 m Fast-paced Walk Test*, a test of short-distance walking speed and direction-change ability, is timed over 4 × 10 m (MCID is 0.3 m/s [32]). The *Stair Climb Test* records the time taken to ascend and descend a flight of stairs. The Stair Climb Test in this study was conducted on a flight of eight steps (17-cm step height) with a handrail. As no MCID for the Stair Climb Test was located in the literature, the researchers estimated the MCID for this measure using 0.5 of the baseline standard deviation, which equated to 5.7 s [30]. The *Timed Up and Go Test* is a transition test of ambulatory activity (MCID is 1.4 s [32], normative value is 8 s [34]). The *6 Minute Walk Test* is a test of walking capacity and medium-distance walking activity (MCID is 50 m; normative values are 572 m for males and 538 m for females [34]).

Demographic and clinical data were also collected for each patient including age, gender, type of joint replacement, employment status, primary health condition, co-morbidities, gait aid use, hydrotherapy sessions attended and time (days) from surgery to exercise group commencement. Data regarding hospital length of stay, intensive care admissions and type of prosthesis used were collected from the medical health records

of participants who had their joint replacement surgery within the health network.

Data analysis

Based on population data with retest reliability (0.6) a sample of $N = 70$ would be sufficient to detect a 50% increase in total physical activity in a repeated measures design with power of 0.80 at an alpha level of .05 [35].

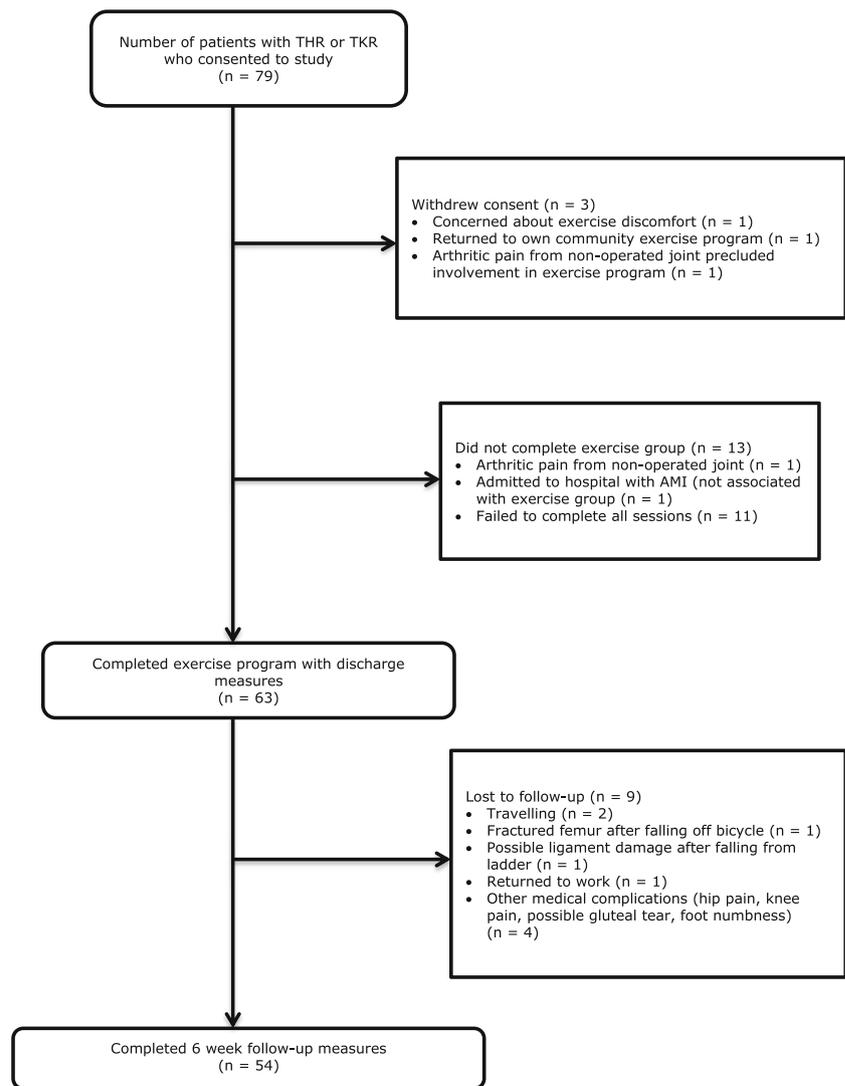
Self-reported physical activity was analysed for skew and kurtosis. Medians and interquartile ranges were calculated for non-parametric data and analysed with Friedman’s and Mann-Whitney U tests. Means and standard deviations were calculated for parametric data and were analysed by linear mixed models (joint [total hip replacement or total knee replacement] × time interaction) adjusting for baseline score with time modelled as a repeated measure. A first order regressive covariance type was used to account for correlated data across time. Missing data were accounted for by using restricted likelihood estimation within the linear mixed model method. A standard multiple regression analysis of six independent variables (age, sex, type of joint replacement (hip vs knee), employment status, gait aid use during one or more walking objective measure assessments (40 m Fast-paced Walk Test, Timed Up and Go Test, 6 Minute Walk Test) at group commencement, time since surgery) using IPAQ self-reported physical activity at group discharge as the dependent variable was conducted. Pearson correlations between change in self-reported physical activity levels and change in functional measures at group discharge (week 6–0) were also calculated. Analyses were completed with IBM SPSS version 24.

The 95% confidence intervals of the adjusted differences from exercise group commencement and the 6-week follow-up were compared with MCID for both primary and secondary outcomes. Changes were considered to be clinically significant if the lower band of the confidence intervals of the mean difference exceeded the MCID. Additionally, the 6-week follow-up results for the 30 s Chair Stand Test, Timed Up and Go Test and 6 Minute Walk Test were compared with published results from age-matched community-dwelling adults. The frequency of participants who exceeded the MCID for all outcome measures was recorded.

Results

Seventy-nine participants were recruited. Three (4%) participants withdrew consent, 13 (17%) did not complete the exercise program and nine (11%) were lost to follow-up. A total of 63 (80%) completed the program and 54 (68%) participants completed the follow-up evaluation (Fig. 1). There were no adverse events. Data describing the type of prosthesis used

Fig. 1 The flow chart of group participant selection



were available for 42 participants (hip = 20, knee = 22). The three most common hip prostheses were Smith & Nephew R3 Anthology ($n = 7$), Stryker Exeter ($n = 5$) and Corail Pinnacle ($n = 4$). The three most common knee prostheses used were Smith & Nephew Genesis II ($n = 9$), Stryker Triathlon ($n = 9$) and Zimmer NexGen ($n = 2$).

Average hospital length of stay calculated from available data ($n = 42$) was 5.4 (SD 2.4) days. Two participants were admitted to intensive care; both completed the study. The primary diagnosis for joint replacement surgery was osteoarthritis ($n = 76$), combined rheumatoid and osteoarthritis ($n = 2$) and rheumatoid arthritis ($n = 1$). Participants averaged 3 (SD 2) co-morbidities with hypertension ($n = 38$), previous hip or knee joint replacement ($n = 21$), gastro-oesophageal reflux disease ($n = 13$), cardiac conditions (e.g. pace maker, acute myocardial infarction, coronary artery bypass graft surgery) ($n = 12$), elevated cholesterol levels ($n = 10$) and respiratory conditions (e.g. asthma, chronic obstructive pulmonary disease) ($n = 10$) the most prevalent.

Of the participants who completed the study, 31 (57%) were women and the mean age was 67.8 (SD 8.0) years. Five (9%) study participants completed 1–3 hydrotherapy sessions, 23 (43%) completed 4–6 hydrotherapy sessions and 26 (48%) did not participate in hydrotherapy. There were no significant differences between those who completed the study and those who did not in terms of age ($p = 0.405$), gender ($p = 0.150$), days since surgery ($p = 0.924$), employment status ($p = 0.191$), type of procedure ($p = 0.970$) and gait aid use ($p = 0.194$) (Table 2).

Physical activity expressed as mean MET-min/week consumed in the week prior to group commencement (week 0) was 1147 (SD 1409), which increased to 3200 (SD 3453) at group discharge (week 6). The consumption of MET-min/week between group discharge and 6-week follow-up (week 12) was observed to increase to 4563 (SD 4789). The increase in MET-min/week consumed between group discharge (week 6) and group commencement (week 0) was both statistically and clinically significant. The increase in MET-min/week

Table 2 Baseline characteristics of participants

Characteristic	Total participants (<i>n</i> = 79)	Complete data (<i>n</i> = 54)	Incomplete data (<i>n</i> = 25)	<i>p</i>
Participants				
Age (yr), mean (SD)	64.3 (7.7)	67.8 (8.0)	66.3 (6.9)	0.405
Range (yr)	(50–87)			
Gender, <i>n</i> (%)				
Male	38 (48)	23 (43)	15 (60)	0.150
Female	41 (52)	31(57)	10 (40)	
Time since surgery, days (SD)	35 (16)	35 (15)	35 (16)	0.924
Employment, <i>n</i> (%)				
Part-time	19 (24)	10 (19)	9 (36)	0.191
Full-time	5 (6)	3 (5)	2 (8)	
Not employed	55 (70)	41 (76)	3 (56)	
Procedure, <i>n</i> (%)				
THR	35 (44)	24 (44)	11 (44)	0.970
TKR	44 (56)	30 (56)	14 (56)	
Walking aid used, <i>n</i> (%)	34 (43)	26 (48)	8 (32)	0.190
Number of sessions, <i>n</i> (SD)	5.5 (1.2)	6.0 (0)	4.4 (1.8)	0.001

FAC forearm crutch, SD standard deviation, SPS single point stick (cane), THR total hip replacement, TKR total knee replacement, yr year, 4WF 4 wheeled frame

consumed between 6-week follow-up (week 12) and group discharge (week 6) was neither statistically nor clinically significant (Table 3). Tests for skew and kurtosis indicated that the self-reported physical activity data were negatively skewed. As a result, IPAQ data were reported with medians and interquartile ranges while functional objective measure data were reported with means and standard deviations. Analysis of joint (hip or knee joint replacement) by time interaction demonstrated no significant differences between type of joint replacement with regard to changes in self-reported physical activity or functional objective measures.

Median self-reported physical activity levels calculated according to IPAQ protocol increased from ‘medium’ (600–3000 MET-min/week) at group commencement to ‘high’ (> 3000 MET-min/week) at group discharge. Self-reported physical activity levels remained ‘high’ at 6-week follow-up. A total of 57% (*n* = 35) of participants exceeded the MCID for self-reported physical activity at group discharge (week 6–0).

Statistically and clinically significant improvement was demonstrated in the 30 s Chair Stand Test, Stair Climb Test, Timed Up and Go Test and 6 Minute Walk Test from group commencement to group discharge compared to baseline scores (Table 3, Fig. 2). Statistically significant improvement was demonstrated in the 40 m Fast Walk Test between group commencement and discharge, but the lower band of the 95% confidence intervals about the mean change did not achieve the MCID (Fig. 2). The proportion of participants who exceeded the MCID at group discharge (week 6–0) for the functional objective measures is recorded in Fig. 2.

The change in 40 m Fast-paced Walk Test and 6 Minute Walk Test between discharge and 6-week follow-up was statistically but not clinically significant. There was no change in other outcomes between discharge and 6-week follow-up. For all secondary outcome measures, there was no difference between joint (hip or knee) and how each joint changed across time (joint × time interaction).

The results at discharge and 6-week follow-up (week 12) were comparable to the reported measures of age-matched community dwellers for the 30 s Chair Stand Test and the Timed up and Go Test. The 6 Minute Walk Test result was below the measure recorded by age-matched community dwellers.

A sensitivity analysis of participants who completed four or more hydrotherapy sessions demonstrated similar results to the full group. This subgroup demonstrated significant gains in all functional measures from group admission to discharge but did not demonstrate a significant gain in physical activity levels from group discharge to 6-week follow-up.

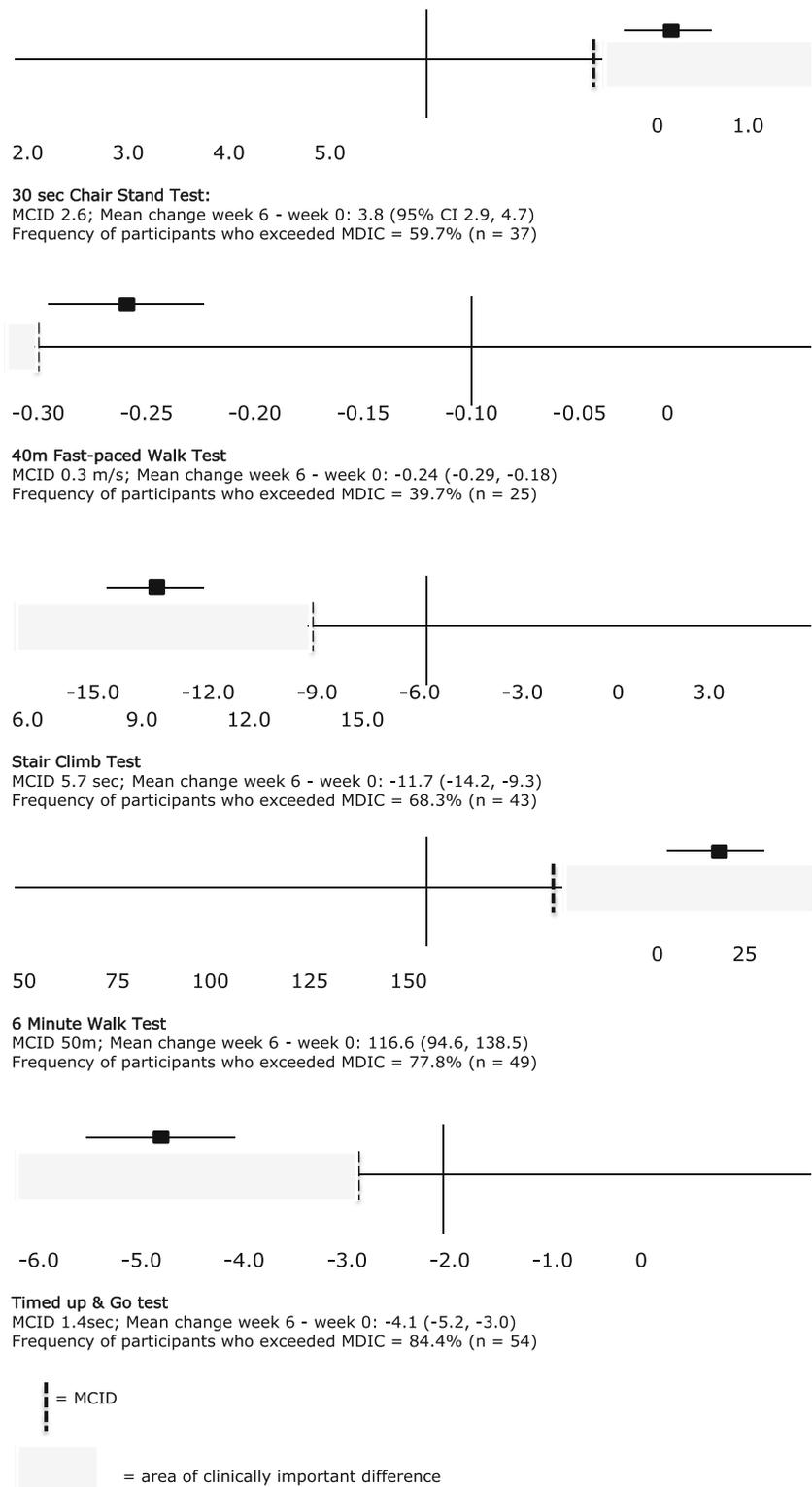
Multiple regression analysis demonstrated that being male ($\beta = 0.37$, $p = 0.003$) and not using a gait aid ($\beta = 0.26$, $p = 0.23$) predicted higher levels of physical activity at discharge ($R^2 = 0.32$, $F(6, 56) = 4.30$, $p = 0.001$). This finding was consistent with results of a Mann-Whitney *U* Test that identified increases in physical activity levels at group discharge were significantly associated with being male ($U = 247.0$, $p = 0.001$). No significant association between changes in physical activity levels and changes in functional objective measures were identified ($r < 0.193$).

Table 3 The median (IQR) or mean (SD) of groups and the median (IQR) or mean (95% CI) difference within groups

Outcome	Group results			Adjusted between time difference			Significance
	Week 0 <i>n</i> = 79	Week 6 <i>n</i> = 63	Week 12 <i>n</i> = 54	Week 6 – Week 0	Week 12 – Week 0	Week 12 – Week 6	
IPAQ (MET-mins/week)	Median (IQR)	Median (IQR)	Median (IQR)	Median difference (IQR)			$\chi^2(2)=26.1, p<0.001$ MW $U=479.0, p=0.923$
	840 (218, 1722)	2171 (939, 5073)	2366 (999, 5925)	Combined THR & TKR	1344 (269, 3921)	145 (-860, 2301)	
				THR	969 (68, 3839)	1166 (-201, 3081)	
				TKR	972 (300, 3540)	627 (-74, 2553)	
					881 (-7, 4074)	-272 (-1480, 1764)	
30 s Chair Stand Test (number)	Mean (SD)	Mean (SD)	Mean (SD)	Mean difference (95% CI)			j: $F(1, 70.6)=0.539, p=0.465$ txj: $F(2, 0.027)=1.033, p=0.359$
	10.4 (2.6)	14.6 (3.1)	15.4 (3.7)	Combined THR & TKR	3.8 (2.9, 4.7)	0.6 (-0.2, 1.4)	
				THR	3.9 (2.7, 5.2)	0.2 (-1.1, 1.5)	
				TKR	3.8 (3.0, 4.6)	1.1 (0.1, 2.1)	
40 m Fast-paced Walk Test (secs)	Mean (SD)	Mean (SD)	Mean (SD)	Mean difference (95% CI)			j: $F(1, 70.6)=0.076, p=0.784$ txj: $F(2, 70.4)=404, p=0.669$
	40.0 (7.4)	29.4 (4.8)	28.0 (5.2)	Combined THR & TKR	-9.5 (-11.7, -7.2)	-2.2 (-3.6, -0.7)	
				THR	-8.8 (-11.0, -6.5)	-2.7 (-4.9, -0.5)	
				TKR	-9.4 (-11.7, -7.0)	-10.9 (-12.8, -8.9)	
Stair Climb Test (secs)	Mean (SD)	Mean (SD)	Mean (SD)	Mean difference (95% CI)			j: $F(1, 70.2)=1.46, p=323$ txj: $F(2, 91.6)=2.43, p=0.094$
	25.8 (11.3)	14.0 (5.7)	12.9 (5.4)	Combined THR & TKR	-11.7 (-14.2, -9.3)	-1.6 (-3.4, 0.3)	
				THR	-8.7 (-11.6, -5.8)	-1.2 (-4.1, 1.8)	
				TKR	-11.8 (-14.2, -9.3)	-1.9 (-4.3, 0.6)	
6 Minute Walk Test (metres)	Mean (SD)	Mean (SD)	Mean (SD)	Mean difference (95% CI)			j: $F(1, 76.8)=0.4, p=0.884$ txj: $F(2, 88.8)=0.38, p=0.094$
	315.2 (88.8)	432.5 (83.5)	459.1 (94.7)	Combined THR & TKR	140.3 (118.6, 162.1)	29.6 (13.2, 45.9)	
				THR	106.1 (83.6, 128.6)	31.2 (11.2, 59.0)	
				TKR	116.9 (93.6, 140.3)	22.9 (-0.1, 45.8)	
Timed Up & Go Test (secs)	Mean (SD)	Mean (SD)	Mean (SD)	Mean difference (95% CI)			j: $F(1, 69.9)=0.058, p=0.81$ txj: $F(2, 105.8)=0.575, p=0.564$
	14.1 (5.3)	9.1 (2.5)	8.5 (2.0)	Combined THR & TKR	-4.1 (-5.2, -3.0)	-0.7 (-1.6, 0.3)	
				THR	-4.8 (-6.1, -3.5)	-0.8 (-2.4, 0.7)	
				TKR	-4.1 (-5.2, -3.0)	-0.5 (-1.6, 0.7)	

IQR interquartile range, *j* joint, *MW* Mann-Whitney, *SD* standard deviation, *THR* total hip replacement, *TKR* total knee replacement, *txj* time × joint

Fig. 2 The mean change (95% CIs) week 6–week 0 vs minimal clinical important difference (MCID)



Discussion

Overall, this study found that participants in an outpatient rehabilitation exercise group increased self-reported physical activity levels and functional performance measures. There

were no significant differences in physical activity or functional measures detected between hip and knee joint replacements, which suggest combining patients with both types of surgery in a single rehabilitation group may be justified. Our study also found no association between changes in physical

activity levels and changes in functional measures at group discharge, which indicates that observed gains in physical activity and functional performance likely occurred independently of each other.

Participation in an exercise group in the early stages of outpatient rehabilitation (on average between five to 11 weeks after surgery) had a positive influence on physical activity levels after joint replacement. It is possible the social support experienced in a group context provided the necessary confidence, motivation and self-efficacy to increase daily physical activity levels; patients appeared to be able to translate physical activity experienced in the group into regular activity. These results appear to contrast with recent systematic reviews that found physical activity levels did not change after joint replacement surgery [1, 6]. However, both systematic reviews compared preoperative with postoperative physical activity levels. Therefore, our study adds to the body of evidence by demonstrating that the participants in an outpatient rehabilitation exercise group can increase levels of physical activity in the first few months after surgery.

Usual-care rehabilitation after hip or knee joint replacement is typically delivered in a one-to-one setting and focuses on improving muscle strength, joint range-of-motion, balance and mobility [12, 13]. There appears to be an assumption that, as function improves and pain levels decrease, an individual's physical activity levels will also increase [3]. However, while improvement in pain and function is well documented [36–38], recent evidence suggests that physical activity levels do not improve after hip or knee joint replacement [1, 6, 39]. The implication is that usual care after hip or knee joint replacement fails to sufficiently address low physical activity levels; physical activity and physical function appear to be separate constructs that are not addressed equitably by usual care after lower limb joint replacement. This was supported by our observation that there was no association between changes in physical activity and functional performance.

It is likely the functional strengthening, range of movement and balance components of the group program were important contributors to the observed improvement in participant function. In addition, the group component of the intervention may have included elements that promote physical activity levels. Exercise delivered in a group setting not only caters to the patient's physical requirements, but may also influence behaviour change through social connectedness, group cohesion and working towards a common goal. The results of our study indicated that males in particular responded well to a group environment. Exercise in a group setting has been associated with decreased rate of perceived effort and increased enjoyment for the same task compared to exercising alone [16]. Further, exercise delivered in a group has been found to have the greatest influence on exercise adherence [40, 41]. However, while group exercise may influence physical activity levels during group participation, group exercise did not

appear to instil participants with strategies that enable a continued increase in physical activity levels once group participation finished. Physical function may be improved by increasing an individual's physical capacity and reducing impairment, but physical activity levels appear more aligned with an individual's behaviour and belief systems [42].

The results may be used to inform future studies that have the primary aim of improving physical activity levels after hip or knee joint replacement. A meta-analysis that evaluated the efficacy of education interventions to increase physical activity among chronically ill adults reported that some education components are effective in modifying physical activity levels [43]. It follows that high-quality randomised controlled trials evaluating the impact of additional behavioural change strategies e.g. education components incorporated into usual care are required. Further, there is a lack of qualitative research in the area of physical activity after hip or knee joint replacement. If physical activity levels in the hip and knee replacement population are linked to an individual's behaviour and belief systems, qualitative studies may prove beneficial in exploring the barriers and facilitators that influence physical activity levels.

This study has a number of potential clinical implications. Rehabilitation conducted early after hip or knee joint replacement in a group setting may positively influence physical activity levels. Also, functional exercise delivered in a group setting may lead to meaningful functional improvement after joint replacement. Combining patients with hip or knee joint replacement in the same exercise group is beneficial for both surgery types. Additionally, the results of this study may assist clinicians to identify patients who may be at risk of continued low levels of physical activity after joint replacement, women and those who use a gait aid.

This study contains a number of limitations. There was no control group to account for natural progression of recovery after hip or knee joint replacement. Also, the IPAQ relies on participants' accurate recall of recent physical activity. Self-reported physical activity levels are often over-reported by individuals in comparison to objectively measured physical activity levels [44]. Low participant numbers limit the generalisability of study results. There was a high number of drop outs ($n = 25$) from the study. However, a comparison of demographic data did not detect significant differences between the participants who completed the study and those who dropped out. Further, a linear mixed models analysis, with restricted likelihood estimation within the linear mixed model method, was used to account for missing data.

Conclusion

Group-based therapy after hip or knee joint replacement was associated with improved physical activity levels while

participants attended the program. Walking performance but not physical activity levels continued to improve after group discharge. High-quality qualitative and quantitative studies are required to identify strategies that lead to sustained physical activity level increases after hip or knee joint replacement.

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Compliance with ethical standards

This study was approved by the Eastern Health Human Research Ethics Committee (approval number LR111/1314). Written informed consent was obtained from all participants.

Disclosures None.

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Key points

- Physical activity levels remain low after hip or knee joint replacement and fail to meet recommended minimal activity guidelines.
- Usual care after hip or knee joint replacement does not appear to address low levels of physical activity.
- Group exercise after hip or knee replacement may increase self-reported physical activity levels during group participation.