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Participant-selected music and physical activity in older adults following cardiac rehabilitation: a randomized controlled trial

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Abstract

Objective: To evaluate effects of participant-selected music on older adults' achievement of activity levels recommended in the physical activity guidelines following cardiac rehabilitation.

Design: A parallel group randomized controlled trial with measurements at Weeks 0, 6 and 26.

Setting: A multisite outpatient rehabilitation programme of a publicly funded metropolitan health service.

Subjects: Adults aged 60 years and older who had completed a cardiac rehabilitation programme.

Interventions: Experimental participants selected music to support walking with guidance from a music therapist. Control participants received usual care only.

Main measures: The primary outcome was the proportion of participants achieving activity levels recommended in physical activity guidelines. Secondary outcomes compared amounts of physical activity, exercise capacity, cardiac risk factors, and exercise self-efficacy.

Results: A total of 56 participants, mean age 68.2 years (SD = 6.5), were randomized to the experimental ($n=28$) and control groups ($n=28$). There were no differences between groups in proportions of participants achieving activity recommended in physical activity guidelines at Week 6 or 26. Secondary outcomes demonstrated between-group differences in male waist circumference at both measurements (Week 6 difference -2.0 cm, 95% CI -4.0 to 0 ; Week 26 difference -2.8 cm, 95% CI -5.4 to -0.1), and observed effect sizes favoured the experimental group for amounts of physical activity ($d=0.30$), exercise capacity ($d=0.48$), and blood pressure ($d=-0.32$).

Conclusions: Participant-selected music did not increase the proportion of participants achieving recommended amounts of physical activity, but may have contributed to exercise-related benefits.

Keywords

Cardiac rehabilitation, music, physical activity, older adults, exercise

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Introduction

Older adults with cardiovascular disease frequently have a history of sedentary behaviour, exercise intolerance, and fatigue, along with misconceptions about physical activity. These factors often act as barriers for older adults as they attempt to adopt and maintain exercise programmes following discharge from cardiac rehabilitation.^{1,2,3} Consequently, 47% of patients do not adhere to levels of activity recommended by physical activity guidelines two months after completing cardiac rehabilitation and this rises to 60% by 12 months.⁴ This inability to achieve recommended levels of physical activity significantly increases the risk of further cardiac and other adverse clinical events.²

It is important to identify strategies that support older adults to engage independently in physical activity and exercise.^{3,5} To maximize exercise compliance and lifestyle change, strategies should be convenient, accessible, and tailored to the individual.³ Music is an accessible, inexpensive, and motivating stimulus that can be individualised for personal preferences, and might support increased exercise participation and physical activity in older adults following discharge from cardiac rehabilitation programmes.⁶

A systematic review demonstrated that listening to music during exercise programmes lasting several weeks offers older adults cumulative benefits leading to improved exercise endurance.⁷ However, none of the 12 reviewed trials examined older adults from cardiac rehabilitation programmes or the achievement of activity recommended in physical activity guidelines. Moreover, most trials evaluated effects of researcher-selected rather than participant-selected music.⁷ One recently published parallel group randomized controlled trial has demonstrated preliminary evidence that personalised music assisted cardiac rehabilitation patients to achieve increased total volumes of physical activity over a three-month period.⁸

We compared older adults receiving participant-selected music and usual care (experimental group) with usual care alone (control group) over six months following discharge from cardiac rehabilitation. The primary aim was to compare groups for proportions of participants who achieved levels of

activity recommended in physical activity guidelines. Secondary aims were to compare groups for differences in amounts of physical activity, exercise capacity, cardiac risk factors, and exercise self-efficacy.

Method

This trial used a single-blind parallel group randomized controlled design with one-to-one allocation. Participants were recruited from the multisite outpatient cardiac rehabilitation programme of a large publicly funded metropolitan health service. A concealed method was used to allocate participants to either participant-selected music for use while performing walking-based exercise (experimental) or usual care (control). A sequence planner with permuted blocks was used to generate participant allocations.⁹ An independent researcher, not involved in recruitment or data collection, sealed the assignments in sequentially coded opaque envelopes.

A blinded assessor administered outcome measures at discharge from the cardiac rehabilitation programme (baseline), and at Weeks 6 and 26. The Week 6 measurement time-point was consistent with previous research examining short-term physical activity adherence following cardiac rehabilitation,⁴ and effects of music on physical activity in older adults.^{10,11} Longer-term physical activity levels were examined at Week 26.

Approval to conduct this trial was obtained from relevant health service and university ethics committees, and all participants provided written informed consent. The trial design was registered prospectively with the Australian and New Zealand Clinical Trials Register (ID: ACTRN12613001369718).

Patients were eligible to participate if they: walked independently with or without walking aids; demonstrated a low falls risk assessed using the Falls Risk for Older People in the Community Screen with a score of ≤ 3 out of 9;¹² demonstrated intact cognitive functioning with an Abbreviated Mental Test Score ≥ 9 out of 10;¹³ completed at least 8 of 10 available cardiac rehabilitation sessions regardless of primary diagnosis; had functional hearing with or without hearing aids; and were aged 60 years or older.

The cardiac rehabilitation programme offered exercise and information sessions twice a week for five weeks. All participants received formal education presentations and handouts explaining physical activity guidelines. Participants in both groups were asked to follow these guidelines after discharge from the cardiac rehabilitation programme using walking as the recommended mode of moderate level physical activity. Researchers phoned participants in both the experimental and control groups, weekly for the first six weeks and monthly thereafter, to monitor for adverse events and provide technical support for equipment if allocated to the experimental group. The phone calls did not offer exercise support such as coaching, advice, or encouragement.

In addition to usual care, participants allocated to the experimental group met with a music therapist for a single session assessment to select preferred music for walking-based exercise. Drawing on a conceptual framework,⁶ the music therapist guided participants to select music they felt would promote physiological arousal and positive subjective experiences while walking. Participants were free to select an unlimited music playlist sourced from their own music collection, the iTunes online store, and a research music library. Furthermore, participants were asked to rate the motivational quality of their music selections for walking-based exercise using the Brunel Music Rating Inventory-2.^{14,15} Selected music was loaded onto lightweight portable music playing (mp3) devices for personal use. Participants were offered an opportunity to review music selections with the music therapist after three months.

Primary outcome

Continuous recording with accelerometer-based activity monitors (ActivPAL, PAL Technologies, Glasgow) were used to calculate proportions of participants in each group who achieved levels of activity recommended in physical activity guidelines.¹⁶ Participants in both the experimental and control groups wore activity monitors continuously for up to eight days at baseline, Week 6, and Week 26. The ActivPAL has demonstrated high inter-device reliability for numbers of steps (absolute error <1%) and cadence (mean difference <1 step

in older adults.¹⁷ Physical activity was compared against guidelines recommending at least 150 minutes accumulated moderate to vigorous physical activity per week, achieved with and without 10-minute bouts.¹⁸ Walking cadence >100 steps per minute^{19,20} and metabolic equivalents >3²¹ were used as threshold values to define moderate to vigorous physical activity in older adults.

Secondary outcomes

Amounts of physical activity and sedentary behaviour recorded by the accelerometers were described as daily minutes of moderate to vigorous physical activity (cadence >100 steps per minute), numbers of steps, and daily hours spent sitting or lying. Exercise capacity was measured using the 6-minute walk test.²² The 6-minute walk test is a valid and reliable test of exercise capacity²³ with a minimally clinically important difference of 25 m for patients in cardiac rehabilitation.²⁴ Elevated cardiovascular risk factors were indicated if body mass indices were <18.5 or >24.9 kg/m², systolic/diastolic blood pressure was >140/90 mmHg, and waist circumference was >94 cm for men and >80 cm for women.²⁵ Participants completed three exercise self-efficacy scales (1 to 10 – very confident) measuring exercise barriers, duration, and frequency.²⁶

The sample size was based on the difference between independent proportions. Assuming 0.30 of patients in cardiac rehabilitation receiving usual care (control group) meet the clinical target each week (150 minutes of moderate to vigorous physical activity),⁵ 24 participants were required in each group for a power of 0.80 at an alpha level of 0.05 using a two-tailed test to detect a large difference of 0.40 between the groups in the proportion achieving activity levels recommended by the guidelines. To account for drop-outs, we aimed to recruit 53 participants.

Numbers and percentages of participants meeting recommended guidelines of 150 minutes moderate to vigorous physical activity with and without bouts were calculated for each group at baseline, Week 6, and Week 26, and odds ratios were calculated through logistic regression. To adjust for any differences at baseline, logistic regression used

baseline proportions and group allocation as independent variables.

Analysis of covariance using baseline measures as covariates, determined whether secondary outcomes of moderate to vigorous physical activity minutes, step count, time spent sitting/lying, 6-minute walk test distance, blood pressure, body mass indices, waist circumference, and self-efficacy improved more in the experimental than control group at Weeks 6 and 26.²⁷ Standardised mean differences, bias corrected (*d*) were calculated for all secondary outcome measures. Odds ratios were calculated for cardiac risk factors. All analyses were conducted according to intention-to-treat principles, with all available data analysed as allocated.²⁸

Results

Participants were recruited between February and December 2014 (Figure 1). The sample comprised of 44 men (79%) and 12 women (21%), with a mean age of 68.2 years (*SD*=6.5). Participants were admitted to cardiac rehabilitation with diagnoses of cardiac disease without an event (23/56, 41%), myocardial infarction (22/56, 39%), conduction disorders (5/56, 9%), heart failure (4/56, 7%), and valve disease (2/56, 4%). Baseline measures demonstrated similarity between the groups based on gender distribution, age, cardiac conditions, and medical treatment/procedures. The experimental group appeared to be more physically active than the control group at baseline (Tables 1 and 2).

There were two reported adverse events related to the trial. One participant reported mild redness on their thigh under the dressing used to attach the activity monitor. Another participant in the experimental group described discomfort wearing the bud style earphones but was able to continue with over-ear style headphones. One participant in the experimental group died three weeks before the measurement at Week 26 following an incident that was not related to the trial.

Music playlists selected by experimental participants ranged from 39 to 850 pieces of music (Mean = 199, *SD* = 192). Music assessments were between one and four hours in duration. Four of the 28 participants requested a review of their music

playlist at three months. Of 28 experimental participants, 27 reported walking with their mp3 players on one to seven days of the week (mean = 4.7, *SD* = 1.7) over the first six weeks in logbooks, and continuing regular use for the remainder of the six-month trial in postinterviews and monthly phone calls. One experimental participant reported no use of their mp3 player during the trial.

There was no difference in odds of participants in the experimental group compared with the control group achieving levels of activity recommended in physical activity guidelines at Week 6 or Week 26. Adherence with physical activity guidelines was low across the sample, with 150 minutes of moderate to vigorous physical activity (according to cadence >100) in 10-minute bouts achieved by 14 of 55 (25%) participants at Week 6, and 12 of 53 (23%) participants at Week 26 (Table 2).

There were no between-group differences in daily minutes walking at cadence >100 with or without bouts, numbers of steps, or hours spent sitting/lying. A small effect size favouring the experimental group was observed for minutes walked at cadence >100 without bouts at Week 6 (*d*=0.30, 95% *CI* -0.24 to 0.82).

There were no between-group differences for the 6-minute walk test. The experimental group demonstrated significantly improved within group 6-minute walk test performance at Week 6 (*p*=0.02) and Week 26 (*p*<0.01). A moderate effect size favouring the experimental group was observed at Week 26 (*d*=0.48, 95% *CI* -0.07 to 1.03).

Males in the experimental group demonstrated significant reductions in waist circumference compared with the control group, and moderate effect sizes were observed at Week 6 (*d*=-0.65, 95% *CI* -1.27 to -0.04) and Week 26 (*d*=-0.68, 95% *CI* -1.30 to -0.05). There were no between-group differences in female waist circumference. Healthy waist circumference across the sample was recorded for 9 of 55 (16%) participants at Week 6, and 11 of 53 (21%) participants at Week 26.

There were no between-group differences in blood pressure. The experimental group demonstrated a significant within group improvement in diastolic blood pressure at Week 26 (*p*=0.05), and a small effect size was observed (*d*=-0.32, 95% *CI*

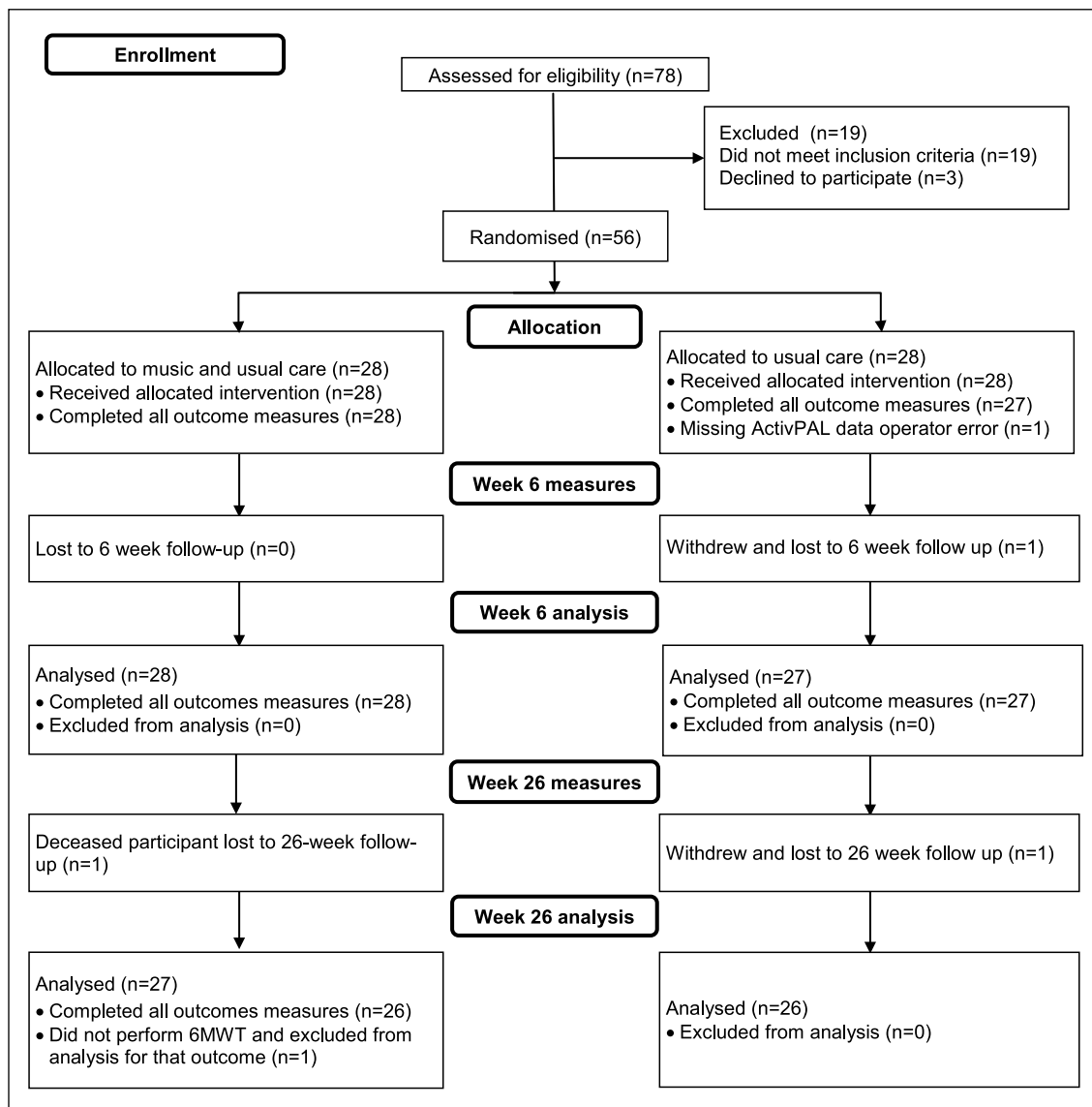


Figure 1. Participant flow.

−0.9 to 0.2). Healthy blood pressure (systolic and diastolic) across the sample was recorded for 37 of 55 (67%) participants at Week 6, and 27 of 53 (51%) participants at Week 26.

There were no between-group differences in body mass indices. A small effect size favouring the experimental group was observed for reduced

body mass indices at Week 26 ($d = -0.35$, 95% CI −0.9 to 0.2). Healthy body mass indices across the sample were recorded for 8 of 53 (15%) participants at Week 6 and 8 of 53 (15%) participants at Week 26. There were no between-group differences in exercise barrier, duration, or frequency self-efficacy at Week 6 or 26 (Tables 2 and 3).

Table 1. Baseline characteristics of participants.

Characteristic	Randomized (n=56)		Analysed at Week 26 (n=53)	
	Exp (n=28)	Con (n=28)	Exp (n=27)	Con (n=26)
Age (yr), mean (SD)	67.3 (4.2)	69.2 (8.2)	67.3 (4.3)	69.7 (8.3)
Gender, n males (%)	21 (75)	23 (82)	21 (78)	21 (81)
Cardiac condition, n (%)				
STEMI	8 (29)	4 (14)	8 (30)	4 (15)
NSTEMI	4 (14)	6 (21)	4 (15)	6 (23)
Conduction disorders	3 (11)	2 (7)	3 (11)	2 (8)
Unstable angina	10 (36)	13 (46)	10 (37)	11 (42)
HF/CHF/cardiomyopathy	2 (7)	2 (7)	1 (4)	2 (8)
Valve disease/aortic stenosis	1 (4)	1 (4)	1 (4)	1 (4)
Medical treatment/procedures, n (%)				
PCI	18 (64)	14 (50)	17 (63)	14 (54)
CABGS	4 (14)	5 (18)	4 (15)	4 (15)
PPM	3 (11)	0 (0)	3 (11)	0 (0)
AVR surgery	1 (4)	1 (4)	1 (4)	1 (4)
Medical management	2 (11)	8 (29)	2 (7)	7 (27)
Eligibility assessments				
FROP-Com/9 (SD)	0.1 (0.3)	0.2 (0.4)	0.1 (0.3)	0.2 (0.4)
AMTS/10 (SD)	9.9 (0.3)	9.9 (0.4)	9.9 (0.3)	9.9 (0.3)
Cardiac Rehabilitation Sites n (%)				
Site 1	10 (36)	11 (39)	10 (37)	10 (38)
Site 2	8 (29)	8 (29)	7 (26)	7 (27)
Site 3	10 (36)	9 (32)	10 (37)	9 (35)

AMTS: abbreviated mental test score; AVR: aortic valve replacement; CABGS: coronary artery bypass graft surgery; CHF: congestive heart failure; Con: control group; Exp: experimental group; FROP-Com: falls risk for older people in the community; HF: heart failure; NSTEMI: non-ST segment elevation myocardial infarction; PCI: percutaneous coronary intervention; PPM: permanent pacemaker; STEMI: ST segment elevation myocardial infarction.

Discussion

Results from this randomized controlled trial did not demonstrate increased adherence with physical activity guidelines among older adults (aged 60 years and older) who received participant-selected music in comparisons with usual care following cardiac rehabilitation. Numbers of participants across the sample who did not achieve activity levels recommended by physical activity guidelines were high at baseline (73%), and following discharge from cardiac rehabilitation at Week 6 (75%) and Week 26 (77%). High proportions of participants across the full sample also presented with significant cardiac risk factors. The lack of physical activity and elevated risk factors

demonstrate an increased likelihood of recurring morbidities among participants.²⁵ Overall, our results indicate that participant-selected music was not sufficient to facilitate changes in behaviour required for the achievement of activity levels recommended in physical activity guidelines.

The music intervention did not incorporate additional behaviour change strategies, which are recommended to improve compliance with physical activity guidelines.²⁹ Behaviour change techniques, including goal-setting, problem solving, self-monitoring, and planned social support (family, friends, colleagues), have been successfully integrated into cardiac rehabilitation to promote physical activity.³⁰ Motivational interviewing has also contributed to modest increases in amounts of

Table 2. Proportions of participants: (a) meeting recommended levels of physical activity (primary outcome); (b) with healthy markers of cardiovascular risk (secondary outcome).

	Week 0		Week 6		Week 26			
	Exp n of 28 (%)	Con n of 28 ^a (%)	Exp n of 28 (%)	Con n of 27 (%)	OR Exp/Con 95% CI	Exp n of 27 (%)	Con n of 26 (%)	OR Exp/Con 95% CI
(a) Primary outcome								
150 minutes accumulated cadence > 100	15 (54)	11 (41)	13 (46)	7 (26)	2.74 (0.68, to 11.15)	11 (41)	9 (35)	1.16 (0.34 to 4.03)
150 minutes at cadence > 100 in bouts	9 (32)	6 (22)	8 (29)	6 (22)	0.85 (0.12 to 5.83)	7 (26)	5 (19)	1.21 (0.30 to 4.87)
150 minutes accumulated METs > 3	9 (32)	7 (26)	11 (40)	6 (22)	2.41 (0.59 to 9.82)	7 (26)	4 (15)	1.83 (0.39 to 8.63)
150 minutes at METs > 3 in bouts	8 (29)	3 (11)	6 (21)	6 (21)	0.22 (0.02 to 1.20)	5 (19)	4 (15)	0.31 (0.03 to 3.19)
(b) Secondary outcome								
Systolic/diastolic BP (<140/90 mmHg)	17 (61)	16 (57)	18 (64)	19 (70)	0.59 (0.15 to 2.23)	17 (63)	10 (39)	2.69 (0.88 to 8.23)
BMI (18.5 < BMI < 24.9)	6 (21)	5 (18)	4 (14)	4 (15)	0.37 (0.30 to 4.54)	4 (15)	4 (15)	0.37 (0.30 to 4.54)
Waist circumference (males < 94 cm, females < 80 cm)	3 (11)	8 (18)	5 (18)	4 (15)	1.25 ^b (0.30 to 5.26)	7 (26)	4 (15)	1.93 ^b (0.49 to 7.57)

BMI: body mass indices; BP: blood pressure; Con: control group; Exp: experimental group; METs: metabolic equivalents.

^aActivPAL data missing for one control participant at baseline owing to operator error.

^bOwing to collinearity, odds ratios for waist circumference were calculated without using baseline proportions as an independent variable.

Table 3. Mean (SD) of groups, mean (SD; 95% CI) within groups, and mean (95% CI) between groups for secondary outcomes.

Outcome	Groups				Difference within groups				Difference between groups					
	W0		W6		W26		W6 minus W0		W26 minus W0		W6 minus W0		W26 minus W0	
	Exp (M=21, F=7)	Con (n=28, M=23, F=5)	Exp (n=28, M=21, F=5)	Con (n=28, M=21, F=5)	Exp (n=27, M=21, F=6)	Con (n=27, M=22, F=7)	Exp	Con	Exp	Con	Exp-Con	Con	Exp-Con	Exp-Con
Cadence > 100 (min/day)	26.1 (19.8)	23.0 (27.0)	27.5 (23.8)	17.1 (17.2)	20.5 (17.6)	18.2 (20.1)	1.4 (15.7)	-2.4 (9.3)	-6.6 (19.8)	-1.8 (14.3)	4.9	-1.8 (14.3)	4.9	-1.76
Cadence > 100 in bouts (min/day)	18.2 (19.8)	12.0 (16.6)	19.8 (22.3)	11.1 (15.5)	13.1 (16.3)	12.4 (20.9)	-4.7 to 7.5	-6.1 to 1.2	-14.4 to 1.3	-7.6 to 4.0	-2.0 to 11.9	-7.6 to 4.0	-2.0 to 11.9	-10.3 to 6.8
Daily steps (n)	8467 (3182)	6535 (3191)	8388 (3830)	6768 (2693)	8136 (3578)	7029 (2646)	1.6 (12.7)	-0.6 (7.2)	-5.8 (18.3)	0.2 (13.8)	2.9	0.2 (13.8)	2.9	-3.47
Sit/lie (hours/day)	18.4 (2.1)	18.5 (1.6)	18.5 (2.0)	18.6 (1.6)	18.1 (2.2)	18.3 (1.7)	-3.3 to 6.5	-3.4 to 2.2	-13.0 to 1.5	-5.4 to 5.8	-2.7 to 8.5	-5.4 to 5.8	-2.7 to 8.5	-1.8 to 4.8
6MWT (m)	522.4 (90.3)	483.9 (103.0)	550.6 (107.0)	496.8 (107.8)	573.1 (87.8)	499.8 (124.7)	-79 (231.9)	302 (2105)	-560 (3167)	482 (2551)	23.6	482 (2551)	23.6	-149.3
Waist, males (cm)	105.1 (9.7)	102.2 (12.1)	102.8 (10.1)	102.8 (10.4)	101.0 (10.7)	101.9 (10.8)	-978 to 820	-531 to 1135	-1813 to 693	-548 to 1513	-1192 to 1239	-548 to 1513	-1192 to 1239	-1667 to 1369
Waist, females (cm)	95.1 (10.0)	105.0 (8.6)	93.9 (11.8)	103.6 (9.1)	92.7 (10.6)	100.6 (11.6)	0.1 (1.3)	0 (1.4)	-0.2 (1.5)	-0.3 (1.2)	0	-0.3 (1.2)	0	0
Systolic BP (mmHg)	132.5 (16.1)	131.9 (19.6)	132.6 (19.7)	131.9 (14.3)	135.3 (18.7)	138.7 (16.0)	-0.4 to 0.6	-0.6 to 0.6	-0.8 to 0.4	-0.8 to 0.2	-0.7 to 0.7	-0.8 to 0.2	-0.7 to 0.7	-0.7 to 0.8
Diastolic BP (mmHg)	80.0 (14.3)	78.3 (11.3)	78.9 (12.8)	78.4 (11.6)	77.1 (9.7)	77.4 (11.5)	28.3 ^a (61.9)	14.4 (42.3)	41.7 ^a (49.0)	16.0 (55.3)	15.5	16.0 (55.3)	15.5	25.0
BMI (kg/m ²)	28.5 (4.2)	28.7 (4.3)	28.4 (4.3)	29.0 (4.2)	28.3 (4.4)	29.3 (4.1)	4.2 to 52.3	-2.3 to 31.2	22.0 to 61.5	-6.4 to 38.3	-14.1 to 45.1	-6.4 to 38.3	-14.1 to 45.1	-5.4 to 55.4
SE-barrier (l-10)	8.0 (1.8)	8.1 (1.7)	7.5 (2.1)	8.0 (1.6)	8.1 (1.9)	8.4 (1.6)	-2.24 ^a (2.9)	0 (3.8)	-4.1 ^a (4.0)	-1.1 (4.7)	-2.0 ^a	-1.1 (4.7)	-2.0 ^a	-2.8 ^a
SE-duration (l-10)	8.9 (1.7)	8.5 (1.6)	8.3 (2.5)	8.3 (2.1)	8.8 (1.9)	8.7 (1.5)	-3.6 to -0.9	-1.7 to 1.7	-5.9 to -2.3	-3.2 to 1.0	-4.0 to 0	-3.2 to 1.0	-4.0 to 0	-5.4 to -0.1
SE-frequency (l-10)	8.7 (2.1)	9.0 (1.6)	8.44 (2.26)	8.6 (2.0)	8.9 (1.5)	8.9 (1.7)	-1.3 (2.1)	-1.4 (2.6)	-2.5 ^a (1.1)	-4.4 ^a (3.4)	1.25	-4.4 ^a (3.4)	1.25	2.7

W0: Week 0; W6: Week 6; W26: Week 26; Exp: experimental group; Con: control group; M: males; F: females; 6MWT: 6-minute walk test; BMI: body mass index; BP: blood pressure; min: minutes; SE: self-efficacy. ^aIndicates p < 0.05.

physical activity in people with chronic health conditions.³¹ Additional behaviour change strategies could be combined with participant-selected music to augment effects in future research.

The music therapist provided guidance for experimental participants that aimed to enhance physiological arousal and subjective experience during walking-based exercise. This was done by encouraging free selection of music with personally motivating elements (rhythm, tempo, melody, harmony, lyrics) and associations (cultural, films, memories).⁶ This approach tested the influence of music as a whole on exercise performance, rather than emphasising any particular musical elements. However, tempo has a strong impact on exercise performance,⁶ as demonstrated in a recently published feasibility study, which used personalised music limited by tempo within 10 beats of walking cadence to increase amounts of physical activity in cardiac rehabilitation patients.⁸ Further research testing participant-selected music with tempo matched to walking cadence might also have an impact on the achievement of activity levels recommended in physical activity guidelines.

While there was no difference in the likelihood of meeting physical activity guidelines between the two groups, there was some preliminary evidence suggesting benefits in exercise-related outcomes for the experimental group. The small effect size favouring amounts of moderate to vigorous physical activity completed by experimental participants at Week 6 may have had a carry-over effect on reduced male waist circumference at both measurements, and at Week 26 on 6-minute walk test performance, diastolic blood pressure, and body mass indices. Experimental participants also walked 25 m further than the control group over the 6-minute walk test at Week 26, a distance recognised as the minimal clinically important difference in adults with coronary artery disease.²⁴ However, these observed exercise-related benefits were not sufficient to have an impact on the achievement of activity levels recommended in physical activity guidelines.

A main strength of the current trial was the use of a single-blinded randomized design so there was a low risk of bias. Further, to our knowledge, this

trial was the first to compare effects of participant-selected music with usual care on older adults' achievement of activity levels recommended in physical activity guidelines following cardiac rehabilitation. The physical activity guidelines represent optimal levels of activity for older adults,¹⁸ and objective results gained from this project provide a platform for further research examining the effects of music on older adults' physical activity adherence.³²

Achievement of activity levels recommended by activity guidelines was low across the full sample at all measurements, despite graduation from cardiac rehabilitation. While the number and frequency of sessions in the cardiac rehabilitation programme attended by participants in this project met Australian standards^{33,34} our results may not be generalisable to cardiac rehabilitation programmes of longer duration. Further, this trial recruited participants aged 60 years and older, and is not representative of cardiac rehabilitation programmes with younger adults. Nonetheless, the low compliance with physical activity guidelines suggests further research examining the efficacy of cardiac rehabilitation programmes may be warranted.

The trial was limited by the small sample size of 56 participants, so that it was only powered to detect a relatively large (40%) difference in the proportion of individuals achieving the level of activity recommended by physical activity guidelines over a relatively short exposure time of six months. The maximum difference between the groups in proportions at Week 26 was 11%, a difference that may not be clinically significant even if confirmed in a trial with a much larger sample. The trial was further limited with a greater proportion of participants in the experimental group than the control group achieving levels of activity recommended by physical activity guidelines at baseline. However, participants were randomly allocated to groups and discrepancies between groups at baseline were accounted for in analyses. A final limitation concerned the use of metabolic equivalent cut-off points to calculate the primary outcome, as this measurement is indirect and based on proprietary algorithms. However, results calculated from metabolic equivalent cut-offs >3

were consistent with results calculated from steps >100 per minute.

In conclusion, participant-selected music did not increase the proportion of participants achieving levels of activity recommended by physical activity guidelines, and the incidence of cardiac risk factors across the full sample was high. There was some preliminary evidence from secondary outcome measures suggesting exercise-related benefits in the experimental group. Findings from this trial warrant further research with a larger sample and longer exposure period. To increase the chances of significant effects, further research might augment participant-selected music with established behaviour change strategies,^{29,30} and recognising the impact of tempo in music,⁸ limit pieces of music to those with tempo-matching participant cadence.

Clinical messages

- Exercise with music was not sufficient to increase the proportion of older adults with cardiac disease meeting physical activity guidelines.
- Exercise with music may provide other health benefits for older adults with cardiac disease.

Declaration of Conflicting Interests

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