Journal of Physiotherapy 65 (2019) 16–22

Journal of PHYSIOTHERAPY

journal homepage: www.elsevier.com/locate/jphys

Research

A combined physical activity and fall prevention intervention improved mobility-related goal attainment but not physical activity in older adults: a randomised trial

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KEY WORDS

Randomised controlled trial
Exercise
Accidental falls
Goals
Aged

ABSTRACT

Questions: In people aged ≥ 60 years, does a combined physical activity and fall prevention intervention affect physical activity and mobility-related goal attainment? Does the combined intervention also improve fall rates, daily steps, the proportion of people meeting the physical activity guidelines, quality of life, mood, fear of falling, and mobility limitation? **Design**: Randomised trial with concealed allocation, intention-to-treat analysis and assessor blinding. **Participants**: One hundred and thirty-one people living in the community and aged ≥ 60 years. **Interventions**: The experimental group received one physiotherapist visit, fortnightly telephone-based health coaching, a pedometer, tailored fall prevention advice, and a fall prevention brochure. The control group received the same fall prevention brochure. **Outcome measures**: Primary outcomes were mobility goal attainment (Goal Attainment Scale) and objectively measured physical activity (accelerometer counts per minute) at 6 and 12 months. Secondary outcomes were falls, other physical activity measures, quality of life, fear of falling, mood, and mobility. **Results**: Participants had a mean age of 71 years (SD 6.5) and 31 (24%) had fallen in the past year. The experimental group reported significantly better mobility goal attainment at 6 months compared to controls (OR 2.0, 95% CI 1.1 to 3.7) but this was not maintained at 12 months (OR 1.1, 95% CI 0.6 to 2.1). Physical activity counts were not significantly different between groups at 6 months (MD 13 counts/minute, 95% CI −98 to 124) or 12 months (MD 56 counts/minute, 95% CI −14 to 125). There were no significant between-group differences in the secondary outcomes. **Conclusion**: A combined physical activity and fall prevention intervention was associated with significantly higher mobility goal attainment at 6 months. There was no significant impact on physical activity but future investigation in a larger trial is warranted. **Trial registration**: ACTRN12614000016639. **[Oliveira JS, Sherrington C, Paul SS, Ramsay E, Chamberlain K, Kirkham C, O'Rourke SD, Hassett L, Tiedemann A (2019) A combined physical activity and fall prevention intervention improved mobility-related goal attainment but not physical activity in older adults: a randomised trial. *Journal of Physiotherapy* 65:16–22]**

Introduction

Physical inactivity is recognised as a global pandemic because the population burden of inactivity is unsatisfactorily high.[1,2] Around 31% of the world's population is not meeting the minimum recommendations for physical activity, with the highest risk group for inactivity being older people.[2] Physical activity has well documented health benefits such as reducing the risks of developing many non-communicable diseases and of premature mortality.[1,3] There is also evidence that regular and structured physical activity enhances mobility,[4,5] enabling older people to maximise quality of life and independence for longer.[4]

Health coaching is a relatively low-cost intervention that can promote lifestyle change to combat inactivity[6,7] by using goal attainment, motivational interviewing, and cognitive behavioural strategies.[8,9] Health coaching has been shown to be a promising intervention for supporting patients to improve self-management, motivation, and self-efficacy.[10,11] It can be included as part of a physical activity program, with benefits for older people with a range of health states.[12] However, conclusive evidence on the impact of health coaching on mobility in older people is yet to be established.[12]

Pedometers can encourage daily physical activity among inactive populations,[13,14] and their use is associated with significant decreases in body mass index and blood pressure.[13] The Fitbit tracker[a] is a

https://doi.org/10.1016/j.jphys.2018.11.005

commercially available pedometer that enables users to set individual goals and monitor their activities via an interactive website or smartphone application. In Australia, 51% of older people are regular internet users,[15] and 78% of people aged 65 to 75 years old have a smartphone.[16] Consequently, use of such activity monitors might be feasible in this population.

Falls and fall-related injuries among older people are a major public health issue worldwide and represent one of the most common causes of fatal and non-fatal injuries among older people.[17–19] Around one-third of community-dwelling older people fall every year, and approximately half of them experience recurrent falls.[18–20] Besides the risk of serious injuries, falls are a significant contributor to healthcare utilisation and have a high economic cost globally.[17,19,21]

There is a high level of evidence that exercise reduces the risk of falls.[22] A recent systematic review revealed that there are larger effects on reducing falls obtained from exercise programs that include a higher challenge to balance and a higher dose of training.[23] However, previous trials have shown that physical activity promotion interventions that successfully increased physical activity participation were associated with increased falls among older women,[24,25] which may be explained by the increased exposure to falls hazards in the environment.[20]

Taken together, these findings suggest that physical activity programs for older adults should include fall prevention components such as exercise that challenges balance.[26] However, there is a lack of randomised controlled trials that have studied the effects of a combined physical activity and fall prevention intervention among older people. This study aimed to test the effectiveness of such an intervention.

Therefore, the research questions for this randomised trial were:

1. In people aged $\geq$ 60 years, does a combined physical activity and fall prevention intervention affect physical activity and mobility-related goal attainment?
2. Does the combined intervention also improve fall rates, daily steps, the proportion of people meeting the physical activity guidelines, quality of life, mood, fear of falling, and mobility limitation?

Methods

Design

In addition to prospective registration, a detailed protocol describing the design and methods of the study was published and is freely available online.[26] A pragmatic, parallel-group, assessor-blinded, randomised controlled trial was conducted. After written informed consent was obtained from participants, baseline assessments and the study questionnaire were completed. Participants were randomly assigned (1:1) to either the intervention or control group, by an investigator not involved in recruitment (CS), using a computer-generated random number schedule with randomly permuted block sizes of two and six. Due to the nature of the intervention, participants and health coaches were not blinded. Data from the primary outcomes (mobility-related goal attainment and objectively measured physical activity) and secondary outcomes were collected by a research assistant who was blinded to group assignment.

Participants

Participants were recruited via community-based newspaper advertisements, council websites, and newsletters/mailing lists of established organisations for older people. Inclusion criteria were: community-dwelling; aged $\geq$ 60 years; living at home; regular weekly users of the Internet via a computer or tablet device; and regularly able to leave the house without physical assistance from another person. Participants were ineligible, if they: were housebound (not having gone outside without physical assistance from another person in the past month); had a cognitive impairment (a diagnosis of dementia or a Memory Impairment Screen[27] score of < 5); had insufficient English language skills to fully participate in the program; had a progressive neurological disease; had a medical condition precluding exercise; were already meeting the Australian Physical Activity Guidelines for older adults,[28] operationalised as 150 minutes of moderate-intensity physical activity per week, assessed using the Incidental and Planned Exercise Questionnaire;[29] or had a falls risk assessment in the past year, since they may have already been receiving the fall prevention intervention.

Interventions

Experimental group

Participants allocated to the 6-month experimental intervention received a 2-hour home visit by a trained physiotherapist, including: a face-to-face health coaching session; setting two mobility-related goals; receiving and setting up a pedometer[a]; undergoing a fall risk assessment (Quickscreen);[30] tailored advice; and a fall prevention advice brochure *Staying Active and on Your Feet*.[31]

Participants nominated two mobility-related goals and, in collaboration with a health coach, discussed, planned, and evaluated the goals. Examples of mobility-related goals were: walk for 1 hour, twice per week; improve strength by attending exercise class, once per week; and improve balance by attending Tai Chi class, once per week. The goal-setting discussion was initiated by asking what the participants were trying to accomplish through changing their physical activity behaviour. The discussion also considered how confident the participant was that he or she could achieve the goal, and made adjustments to the goal if the participant was not confident in his or her ability to achieve that goal.

The home visit session was followed by fortnightly telephone health coaching, for a period of 6 months, to support adherence and facilitate behaviour change. Although health coaching was predominantly telephone-based, it involved email contact if preferred by participants or a combination of both. The intervention details are included in Appendix 1 on the eAddenda.

Control group

The control group received the same fall prevention brochure as the experimental group and was advised to continue their usual activities with no restriction placed on physical activity.

Outcome measures

The primary outcomes were objectively-measured physical activity using an accelerometer[b] and mobility-related goal attainment using the Goal Attainment Scale;[32] both were measured at 6 months and 12 months after randomisation.

There were several secondary outcomes. Falls were recorded with monthly falls calendars over 12 months. An accelerometer[b] was used to measure two outcomes: daily step count and the proportion of people meeting the physical activity guidelines of 150 minutes of moderate-intensity to vigorous-intensity physical activity per week. Quality of life was assessed with the self-report European Quality of Life - 5 Dimensions - 3 Level Version (EQ-5D-3L).[33] Fear of falling was assessed using the short-form Falls Efficacy Scale International.[34] Mood was assessed with the positive subscale of the Positive and Negative Affect Schedule.[35] Mobility limitation was assessed using the Late Life Function and Disability Instrument.[36] Except for falls, which were measured over 12 months, all secondary outcomes were measured at both 6 months and 12 months after randomisation.

Experimental group and control group participants also completed a baseline questionnaire that included questions about: sociodemographic details; number of prescription medications taken; number of comorbidities; history of falls, assessed with the question 'How many falls have you had in the past 12 months?'; fear of falling, assessed with the question 'Are you afraid of falling?'; self-rated balance perception, assessed with the question 'Do you feel your

balance is excellent, very good, good, fair or poor?'; and physical activity, measured using the Incidental and Planned Exercise Questionnaire.[29] The experimental group also completed a survey at 6 months to provide their impressions of the intervention, the perceived benefits, and adverse events.

Data analysis

It was estimated that a sample size of 130 participants would provide 80% power to detect a 15% between-group difference in the primary physical activity outcome (ie, a between-group difference in mean counts/minute during wear time of 35), assuming a standard deviation of 91 counts/minute, a dropout rate of 15% and an alpha of 5%. The estimate of mean accelerometer counts/minute was based on accelerometer data from a sample of 263 community-dwelling women aged $\geq$ 65 years.[37] A sample size of 130 was also estimated to provide 80% power to detect a clinically meaningful between-group difference of 20% in goal attainment scores (eg, 10% achieving the goal in the control group and 30% achieving the goal in the experimental group), and between-group differences of 10 to 15% for the secondary outcome measures.

General linear models were used to assess the effect of group allocation on the continuously scored primary (average physical activity counts per minute) and secondary outcome measures (daily steps, quality of life, fear of falling, mood, mobility limitation), at both 6 months and 12 months, after adjusting for baseline scores. We analysed between-group differences in mobility-related goal attainment, at both 6 months and 12 months using ordinal regression. To aid interpretation of the Goal Attainment Scale, the scores were also dichotomised (goal met versus goal not met), and odds ratios (ORs) calculated. A post-hoc subgroup analysis was also conducted using interaction terms in the models to determine whether the physical activity intervention had differential effects in older participants (above and below the mean age).

The number of falls per person-year were analysed using negative binomial regression models to estimate the between-group difference in fall rates after 1 year (secondary outcome). We also used modified Poisson regression models to compare the proportion of fallers and the proportion of people who meet physical activity guidelines between groups. The analyses were pre-planned, conducted while masked to group allocation, and used an intention-to-treat approach.

Results

Flow of participants through the study

Recruitment occurred between January 2014 and August 2015. Follow-up assessments were completed on August 2016. The flow of participants through the study is shown in Figure 1. A total of 158 participants were screened for eligibility and 27 were excluded. A total of 131 participants were randomly assigned to the experimental group (n = 64) or control group (n = 67).

Compliance with the study protocol

Participants randomised to the experimental group received a single home visit, followed by an average of 9.2 (SD 3.2, range 2 to 15) health coaching telephone contacts from the same research physiotherapist, with each session lasting between 10 to 45 minutes.

Of the 131 participants who were randomised, 105 (80%) completed the 6-month objective measure of physical activity, 109 (83%) completed secondary questionnaire-based outcomes, and 126 (96%) completed the assessment of goal attainment. At 12 months, 95 participants (73%) completed the objective measure of physical activity, 98 (75%) completed secondary questionnaire-based outcomes, and 112 (85%) completed the assessment of goal attainment. A total of 103 (86%) participants completed all 12 months of falls calendars.

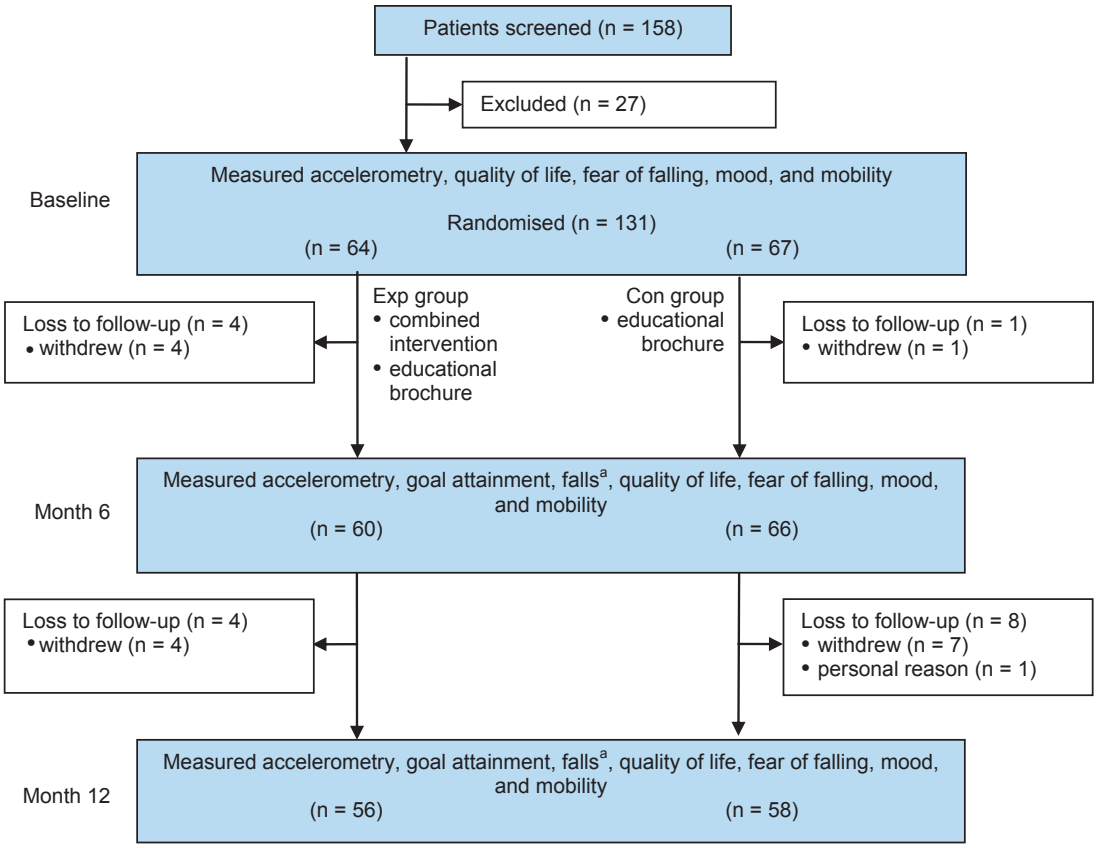

Figure 1. Design and flow of participants through the trial.
[a] Falls were measured monthly.

Baseline characteristics of participants

Table 1 presents the participant baseline characteristics. The groups had comparable baseline characteristics, apart from slightly more self-rated poor balance and fear of falling in the experimental group. Participants self-reported, on average, 30 hours per week of physical activity measured with the Incidental and Planned Exercise Questionnaire, which is a relatively high level of activity compared to the 22 hours per week reported in a previous study involving 315 older community-dwelling Australians.[38]

Effect of intervention

Primary outcomes

The distribution of scores on the Goal Attainment Scale at 6 months and 12 months, presented in Figure 2, indicated better goal attainment by the experimental group at 6 months (OR 2.0, 95% CI 1.1 to 3.7) but no significant between-group difference at 12 months (OR 1.1, 95% CI 0.6 to 2.1). When the Goal Attainment Scale scores were dichotomised to indicate goal attainment or not, the scores did not differ significantly between experimental and control group participants at 6 months (OR 1.9, 95% CI 0.9 to 4.2) or at 12 months (OR 1.0, 95% CI 0.5 to 2.2). Individual participant data are presented in Table 2 on the eAddenda.

Based on accelerometry, physical activity participation, adjusted for baseline scores, did not vary significantly between intervention and control groups at 6 months (MD 13 counts/minute, 95% CI −98 to 124) or at 12 months after randomisation (MD 56 counts/minute, 95% CI −14 to 125). Group data are presented in Table 3. Individual participant data are presented in Table 2 on the eAddenda.

Secondary outcomes

During the 12-month study period, 54 people (41% of participants) reported 109 falls. Of these, one participant in the experimental group sought medical attention after experiencing a fall, and two participants in the control group reported falls that resulted in fracture; however, none of these participants were admitted to hospital as a result of falling. The experimental group reported a higher fall rate (57 falls, 0.95 falls per person per year, SD 1.5) than the control group (52 falls, 0.80 falls per person per year, SD 1.3); however, this difference was not statistically significant (incidence rate ratio (IRR) 1.3, 95% CI 0.7 to 2.2). There was a slightly higher proportion of fallers in the experimental group (27 participants, 45%) than in the control group (27 participants, 42%) but this difference in proportions was not statistically significant (IRR 1.0, 95% CI 0.7 to 1.5). Frequencies and percentages of self-reported falls with selected characteristics by intervention and control groups are presented in Table 4. Individual participant data are presented in Table 2 on the eAddenda.

We identified a non-significant trend towards greater increases in steps/day in the experimental group compared to control group at 6 months (404 steps/day, 95% CI −391 to 1200) and 12 months (637 steps/day, 95% CI −162 to 1438) (Table 3). There was also a trend towards a greater proportion of people in the experimental group who were not meeting physical activity guidelines (ie, 150 minutes/week moderate to vigorous physical activity) at baseline to be meeting guidelines at 6 months compared with the proportion in the control group (OR 4.0, 95% CI 0.78 to 20.15); however, this trend was not maintained at 12 months (Table 5). The analyses also revealed no significant between-group differences in EQ-5D-3L, Falls Efficacy Scale International, the positive subscale of the Positive and Negative Affect Schedule, and Late Life Function and Disability Instrument (see Table 3). However, there was a significant difference in the change scores of the limitation dimension of the disability component in Late Life Function and Disability Instrument at 12 months in favour of the control group. Individual participant data for all secondary outcomes are presented in Table 2 on the eAddenda.

Sub-group analyses for the primary and secondary outcomes

Sub-group analyses identified a greater intervention effect on positive affect scores (from Positive and Negative Affect Schedule) at 12 months in participants who were aged ≥ 71 years (p for interaction = 0.008), but there was no evidence of differential effects by age on any other outcomes at both 6 months and 12 months after randomisation.

Adverse events

Five experimental group participants reported adverse events that may have been associated with the physical activity program. These included low back pain (n = 2), hip pain (n = 1), calf pain (n = 1), and tightness in the chest (n = 1). However, adverse events were not monitored in the control group.

Participant impressions of the intervention

Forty-seven (78%) experimental group participants completed the survey questions on their impressions of the intervention at 6 months. Overall, 39 participants (83%) perceived the intervention to be effective in increasing their activity levels. Most participants (n = 42, 89%) identified that the pedometer[a] motivated them to be more active and 46 (98%) also reported that they wore the pedometer every day or most days during the intervention. Of the participants who planned to be active for the next 6 months, 42 (91%) stated that they would consider wearing the pedometer regularly. Furthermore, 41 (87%) participants identified that health coaching and goal setting encouraged them to be physically active.

Table 1
Baseline characteristics of participants.

Characteristic	Exp (n = 64)	Con (n = 67)
Age *(years)*, mean (SD)	71 (6)	72 (7)
Female, n (%)	43 (67)	50 (75)
Total medications *(n)*, mean (SD)	2.2 (2.2)	2.2 (2.1)
Total co-morbidities *(0 to 26)*[a], mean (SD)	2.9 (1.9)	2.4 (1.8)
Fallen in the past year, n (%)	17 (27)	20 (30)
Self-rated balance fair/poor, n (%)	27 (42)	16 (24)
Self-rated fear of falling ≥ moderate, n (%)	27 (42)	20 (30)
Daily steps *(n)*, mean (SD)	7507 (3077)	7167 (2841)
Meeting physical activity recommendation[b], n (%)	29 (47)	36 (55)
Self-report physical activity *(hours/week)*[c], mean (SD)	29 (18)	30 (18)

Con = control group, Exp = experimental group.

[a] Possible comorbidities recorded included: arthritis, osteoporosis, asthma, chronic obstructive pulmonary disease, angina/ischaemic heart disease/heart attack, congestive heart disease, hypertension, Parkinson's disease, atrial fibrillation, stroke/transient ischaemic attack, peripheral vascular disease, diabetes mellitus, upper gastrointestinal disease, depression, cognitive impairment, anxiety/panic disorder, visual impairment, hearing impairment, cancer, and gout.

[b] 150 minutes/week moderate to vigorous physical activity, measured by accelerometer.

[c] Measured using Incidental and Planned Exercise Questionnaire.

Discussion

The experimental intervention in this study, which aimed at improving physical activity with consideration of fall risk, was effective in promoting mobility goal attainment after 6 months among community-dwellers aged ≥ 60 years. Physical activity counts were not significantly different between groups at 6 months or 12 months. We identified a non-significant trend toward greater increases in steps/day in the experimental group compared to control group at 6 months (404 steps/day, 95% CI −391 to 1200) and 12 months (637 steps/day, 95% CI −162 to 1438). Although these between-group differences were not statistically significant and the mean differences are probably lower than clinically important levels, the wide confidence intervals suggest that further investigation is warranted. Additionally, there was a trend towards a greater number of experimental group participants who were not meeting physical activity guidelines at baseline to meet the guidelines at 6 months. Moreover, there was no overall impact on falls rate from the

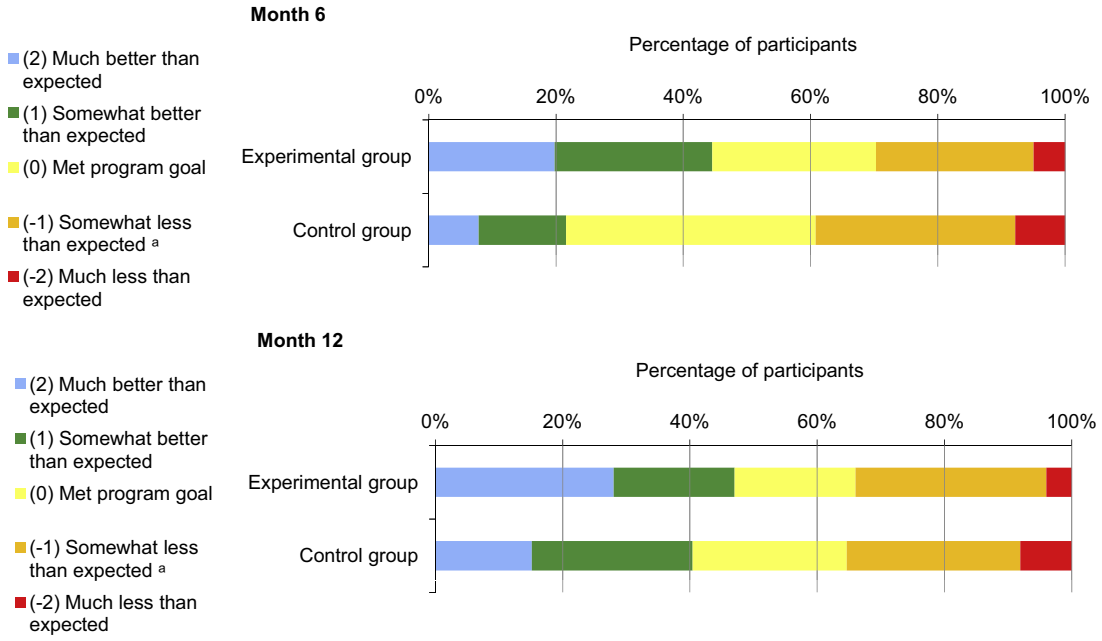

Figure 2. Percentage of participants who achieved the self-selected goals at 6 months and 12 months.
[a] Same as baseline performance.

intervention. No significant between-group differences were found for any of the secondary outcomes at either 6 months or 12 months. Finally, sub-group analyses revealed a significant between-group difference in mood at 12 months in those participants aged ≥ 71 years. Despite the non-significant impact on measured physical activity levels, the intervention package was acceptable to community-dwelling older people.

In contrast to this study, a recent systematic review suggested that health coaching was effective for increasing physical activity among older people.[12] However, this systematic review included clinical populations with somewhat lower levels of physical activity than our sample. Therefore, our findings may have been due, at least in part, to the relatively high levels of baseline physical activity reported by participants in both the experimental and control groups (55% and 47%, respectively, meeting guidelines at baseline). Furthermore, our results may have been impacted by a Hawthorne effect, with monitoring inducing increased physical activity levels in control group participants and hence reducing the between-group differences in our study.

Additionally, the lack of intervention impact on physical activity levels should be interpreted with caution, as this finding may have been due to type II error (failing to detect an effect that exists). The estimate for the sample size was based on accelerometer data from a cross-sectional study, where we assumed a standard deviation of 91 counts/minute, a dropout rate of 15% and alpha of 5%. Using data collected in our sample, we re-calculated the sample size to provide 80% power to detect a 15% between-group difference in the primary physical activity outcome, a dropout rate of 20% and alpha of 5%, and the sample size required was 216 participants, suggesting that the trial was underpowered.

Interestingly, despite the similar improvements in both groups in physical activity levels, we found a significant between-group

Table 3
Mean (SD) of groups at 0, 6 and 12 months, and mean difference (95% CI) in change between groups.

Outcome measures	Groups						Difference between groups (baseline adjusted)	
	Month 0		Month 6		Month 12		Month 6 minus Month 0	Month 12 minus Month 0
	Exp (n = 64)	Con (n = 67)	Exp (n = 54)	Con (n = 55)	Exp (n = 46)	Con (n = 52)	Exp minus Con	Exp minus Con
Counts/minute from accelerometer[a,c]	274 (152)[e]	304 (172)[e]	325 (302)[d]	342 (298)[f]	292 (229)	254 (107)[e]	13 (−98 to 124)	56 (−14 to 125)
Falls efficacy scale *(7 to 28)*[b,c]	10.2 (3.6)	9.6 (3.4)	9.5 (3.2)	9.1 (3.4)	9.6 (3.1)[d]	9.1 (3.0)	0.1 (−0.8 to 1.1)	0.3 (−0.5 to 1.0)
Daily steps *(n)*	6727 (3214)[e]	7167 (2800)[e]	7507 (3077)[d]	7401 (2841)[f]	7010 (3163)	6584 (2612)[e]	404 (−391 to 1200)	637 (−162 to 1438)
EQ-5D-3L *(0.2 to 1)*[a,c]	0.8 (0.2)	0.8 (0.1)	0.8 (0.1)	0.8 (0.1)	0.8 (0.1)[d]	0.8 (0.1)	0.02 (−0.01 to 0.05)	−0.01 (−0.04 to 0.02)
PANAS scale *(10 to 50)*[a,c]	34.5 (8.0)	37.4 (6.9)	36.1 (7.9)	36.3 (7.5)	35.8 (6.7)[d]	37.4 (7.0)	1.7 (−0.5 to 3.9)	0.45 (−1.7 to 2.7)
LLFDI scaled score *(0 to 100)*, mean (SE)[a,c]								
Function component	65.3 (10.4)	67.5 (12.0)	66.2 (9.9)	68.5 (10.7)	66.8 (10.9)[e]	68.9 (9.7)	−1.9 (−4.8 to 0.9)	−1.0 (−3.9 to 1.9)
Disability component: frequency	55.6 (6.9)	57.4 (8.2)	56.3 (7.2)	56.7 (7.9)	55.7 (7.2)[d]	59.1 (8.4)	−0.3 (−2.7 to 2.0)	−1.7 (−4.3 to 0.9)
Disability component: limitation	72.4 (16.3)	74.8 (16.3)	73.1 (15.8)	73.1 (15.0)[e]	70.9 (14.1)[d]	78.6 (13.3)	0.1 (−4.9 to 5.0)	−6.6 (−11.7 to −1.6)

Shaded row = primary outcome
Con = control group, EQ-5D-3L = European Quality of Life - 5 Dimensions - 3 Level Version quality of life utility score, Exp = experimental group, LLFDI = Late Life Function and Disability Instrument, PANAS = Positive and Negative Affect Schedule (Positive affect subscale score).
[a] Higher scores reflect better performance.
[b] Lower scores reflect better performance.
[c] Between-group differences are from linear regression models.
[d] 1 missing.
[e] 2 missing.
[f] 3 missing.

Table 4
Characteristics of self-reported falls by group.

Characteristic of falls	Falls	
	Exp (n = 57)	Con (n = 52)
Place, n (%)		
indoor falls	22 (39)	19 (37)
outdoor falls	33 (58)	32 (62)
Activity during fall, n (%)		
walking	29 (51)	25 (48)
walking up or down stairs	5 (9)	9 (17)
standing	1 (2)	4 (8)
stepping	6 (11)	3 (6)
exercising	1 (2)	2 (4)
other activity	13 (23)	4 (8)
Primary cause of fall, n (%)		
lost balance	12 (21)	18 (35)
tripped on something	8 (14)	8 (15)
slipped on something	28 (49)	22 (42)
any of above	3 (5)	0 (0)
Injuries, n (%)		
no injuries	27 (47)	13 (25)
bruising, cuts and/or grazes	23 (40)	28 (54)
fractures	0 (0)	2 (4)
other injuries	1 (2)	3 (6)
Interventions, n (%)		
none	46 (81)	37 (71)
doctor notified	1 (2)	4 (8)
ambulance called	2 (4)	0 (0)
medical attention	2 (4)	1 (2)
other intervention	0 (0)	2 (4)

Percentages do not add to 100% due to the effects of rounding and missing data.

difference in mobility goal attainment at 6 months, in favour of the experimental group. This mismatch between the impacts of the intervention on physical activity and goal attainment may be explained by the fact that many participants set goals related to balance, strength or specific structured activities, such as yoga or swimming, which are activities that are less detectable with the accelerometer.[39] Therefore, it is possible that this device was not sufficiently sensitive to detect increases in participation for these type of activities. Another possible explanation is that instead of increasing their total volume of physical activity, participants may have replaced their previous physical activities with different activities in working towards baseline mobility goals.

Although we found a significant effect of the intervention on mobility-related goal attainment, there was no significant between-group difference for mobility limitation assessed by the Late Life Function and Disability Instrument at 6 months. We found an improvement in the limitation dimension scores of Late Life Function and Disability Instrument in the control group at 12 months, with a negative change in the experimental group over this time; however, this improvement was not clinically significant. Nevertheless, the interpretation of this unexpected finding requires caution and warrants further investigation.

Despite the absence of a significant impact on physical activity levels, most of the intervention participants reported that the intervention was helpful in encouraging them to be physically active. Research is therefore needed to establish whether changes to the dose and length of health coaching provided is associated with a greater impact on physical activity levels among older people. More effort is also needed in order to target participants who would benefit most from a physical activity program, specifically those recognised as inactive, and to focus on more specific fall-prevention strategies.

This study had several strengths. It followed Consolidated Standards of Reporting Trials (CONSORT) guidelines[40] and the protocol was prospectively registered. It used a pragmatic design with a tailored physical activity and falls prevention package, and broad inclusion criteria. It used concealed random allocation to groups, blinded outcome assessment, and pre-planned statistical analyses using an intention-to-treat approach to minimise bias. It also used an objective measure of physical activity and the recommended method of collecting fall data.[41]

In interpreting the findings, it is important to note that the number of dropouts was a limitation of the study. There was a $>20\%$ dropout rate, which may have introduced some bias and appears to have made the study underpowered to detect an intervention impact on the primary physical activity outcome. This study also had a 27% rate of loss to follow-up in the primary physical activity outcome, which in part reflected the requirement to wear the accelerometer for many days.[42] However, the rates of loss to follow-up were consistent with a recent study which found that adherence to a 7-day accelerometry protocol among older people was low, with only 72% of participants providing at least 4 days of accelerometry data.[42] Future studies should ensure rigorous follow-up methods and a large enough sample size that accounts for realistic loss to follow-up in order to more accurately measure the effect of the intervention on physical activity.

A further potential limitation was that the secondary questionnaire-based outcomes were self-report measures, which are prone to recall and response bias.[43] Furthermore, participants were older people who used the Internet regularly and did not have cognitive impairment or English language difficulties. Thus, the generalisability of the results is limited. Finally, another possible limitation is the fact that participants in the experimental group received only one face-to-face health coaching session and, therefore, most of the health coaching sessions were delivered by telephone. A previous systematic review found that face-to-face health coaching sessions were more effective in increasing physical activity than telephone-based methods.[12] Therefore, it is possible that the health coaching intervention might have different effects if more face-to-face sessions were included as part of the intervention.

In conclusion, the combined physical activity and fall prevention intervention was associated with significantly higher mobility goal attainment at 6 months. Although not statistically and clinically significant, there was a trend towards effects on physical activity that warrants further research. The study also found no effect of the intervention on fall rates, the proportion of people meeting 150 minutes per week of moderate-to-vigorous physical activity, quality of life, fear of falling, mood and mobility limitation. This trial demonstrated intervention acceptability where most participants perceived a positive impact of the intervention on their physical activity levels. The findings suggest that the intervention may be used as a strategy to promote mobility-related goal attainment and

Table 5
Number (%) of participants in each group meeting recommended physical activity level at baseline and 6-month and 12-month follow-up, and odds ratio (95% CI) between groups. Odds ratios are calculated from logistic regression models.

Outcome measure	Groups						Odds ratio (95% CI)	
	Month 0		Month 6		Month 12		Month 6	Month 12
	Exp (n = 62)	Con (n = 65)	Exp (n = 52)	Con (n = 52)	Exp (n = 46)	Con (n = 50)	Exp relative to Con	Exp relative to Con
Meets recommendation of 150 minutes per week of moderate to vigorous physical activity, n (%)	29 (47%)	36 (55%)	29 (56%)	25 (48%)	22 (48%)	21 (42%)	1.2 (0.8 to 1.7)	1.1 (0.7 to 1.8)

Exp = experimental group, Con = control group.

its impact on other outcomes warrants further investigation in larger trials.

What was already known on this topic: Physical inactivity and falls are common among older people. Health coaching and pedometers can promote physical activity. Exercise programs, especially those with a higher challenge to balance and a higher dose of training, reduce the risk of falls. However, physical activity promotion interventions without a fall prevention component may increase falls.

What this study adds: An intervention that combined physical activity and fall prevention components helped older people to achieve their mobility goals at 6 months. While it had no significant effect on physical activity, this warrants further investigation. No significant effect on falls was observed.

Footnotes: [a] Fitbit Inc, San Francisco, CA, USA. [b] GT3X-BT accelerometer, ActiGraph, Pensacola, USA.

eAddenda: Table 2 and Appendix 1 can be found online at DOI: https://doi.org/10.1016/j.jphys.2018.11.005.

Ethics approval: The trial was approved by the Human Research Ethics Committee at the University of Sydney (protocol number 14265). Written informed consent was obtained from all participants prior to their participation in the study.

Competing interest: Nil.

Sources of support: This work was supported by a research bequest in addition to a Marrickville Council Community Grant and funding from the NSW Office of Communities, Sport and Recreation Participation and Facility Program. JO is supported by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), Brazil. CS holds a Research Fellowship from the National Health and Medical Research Council (NHMRC), Australia. AT holds a Career Development Fellowship from the National Health and Medical Research Council (NHMRC), Australia.

Acknowledgements: Nil.

Provenance: Not invited. Peer reviewed.

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