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A systematic review of group walking in physically healthy people to promote physical activity

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Abstract:	Background Walking is a good way to meet physical activity guidelines. We examined the effectiveness of walking in groups compared to walking alone or inactive controls in physically healthy adults on physical activity and quality of life. (PROSPERO CRD42016033752). Methods We searched Medline, Embase, Cinahl, Web of Knowledge Science Citation Index, and Cochrane CENTRAL until March 2016, for any comparative studies, in physically healthy adults, of walking in groups compared to inactive controls or walking alone, reporting any measure of physical activity. We searched references from recent relevant systematic reviews. Two reviewers checked study eligibility and independently extracted data. Disagreements were resolved through discussion. Quality was assessed using likelihood of selection, performance, attrition and detection biases. Meta-analysis was conducted using Review Manager 5.3. Results From 1404 citations, 17 studies were included in qualitative synthesis and 10 in meta-analyses. Thirteen compared group walking to inactive controls and four to walking alone. Eight reported more than one measure of physical activity, none reported according to current guidelines. Group walking compared to inactive controls increased follow-up physical activity (9 RCTs, SMD 0.58 (95%CI 0.34-0.82) to SMD 0.43 (95%CI 0.20-0.66)). Compared to walking alone, studies were too few and too heterogeneous to conduct meta-analysis, but the trend was improved physical activity at follow up for group walking participants. Six (all inactive control) reported quality-of-life: four showed statistically significantly improved scores. Discussion Better evidence may encourage government policy to promote walking in groups. Standardised physical activity outcomes need to be reported in research.

A systematic review of group walking in physically healthy people to promote physical activity

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Authors' contributions, - CM developed the topic. Both authors assessed studies for inclusion, analysed results and wrote the manuscript.

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250 word abstract

Background

Walking is a good way to meet physical activity guidelines. We examined the effectiveness of walking in groups compared to walking alone or inactive controls in physically healthy adults on physical activity and quality of life. (PROSPERO CRD42016033752).

Methods

We searched Medline, Embase, Cinahl, Web of Knowledge Science Citation Index, and Cochrane CENTRAL until March 2016, for any comparative studies, in physically healthy adults, of walking in groups compared to inactive controls or walking alone, reporting any measure of physical activity. We searched references from recent relevant systematic reviews. Two reviewers checked study eligibility and independently extracted data. Disagreements were resolved through discussion. Quality was assessed using likelihood of selection, performance, attrition and detection biases. Meta-analysis was conducted using Review Manager 5.3.

Results

From 1404 citations, 18 studies were included in qualitative synthesis and 10 in meta-analyses. Fourteen compared group walking to inactive controls and four to walking alone. Eight reported more than one measure of physical activity, none reported according to current guidelines. Group walking compared to inactive controls increased follow-up physical activity (9 RCTs, SMD 0.58 (95%CI 0.34-0.82) to SMD 0.43 (95%CI 0.20-0.66)). Compared to walking alone, studies were too few and too heterogeneous to conduct meta-analysis, but the trend was improved physical activity at follow up for group walking participants. Seven (all inactive control) reported quality-of-life: five showed statistically significantly improved scores.

Discussion

Better evidence may encourage government policy to promote walking in groups. Standardised physical activity outcomes need to be reported in research.

What is already known on this subject?

The majority of people are aware that they should be more physically active but it is difficult to motivate people. Much effort has been expended by clinical public health and others to encourage people to undertake more physical activity. Walking is an excellent mode of physical activity and more may take part if the social side of walking in groups was promoted.

What this study adds?

This systematic review demonstrates that walking in groups is more effective than inactivity to increase physical activity in physically healthy people. Far less evidence is available on walking in groups compared to walking alone but the trend was improved physical activity at follow up for participants walking in groups.

Background

The World Health Organisation physical activity strategy recommends that adults undertake 150 minutes of moderate aerobic physical activity such as cycling or fast walking (3-5 miles per hour) or 75 minutes of vigorous activity or a mix of moderate and vigorous activity every week, plus muscle-strengthening exercises on two or more days per week that work all of the major muscles in the body (1;2). However, only a relatively small proportion of adults meet these guidelines. In the USA, in 2014, 49.2% adults met the physical activity guidelines for aerobic physical activity and 20.8% adults met the physical activity guidelines for both aerobic physical and muscle-strengthening activity (3). The equivalent proportions meeting the physical activity guidelines for aerobic physical activity are: 24% of men and 21% of women in Canada (4), 40% of adults in Australia(5), and 67% of men and 55% of women in the UK(6).

Dropout rates for exercise initiatives are known to be high (7;8). However, there is good evidence that exercise adherence is enhanced through the use of social support (9;10). A recent mixed-methods systematic review on community-based group exercise interventions for older adults found that increased social connectedness, wellbeing gains and an empowering environment were themes associated with above average long-term adherence rate (11). This study concluded that incorporating participants' views into exercise programme designs could provide guidance for innovative interventions, which would lead to sustained adherence.

Walking is a highly accessible form of physical activity, and is associated with a range of positive health benefits (12;13). Governments have strongly encouraged the public to increase physical activity through walking. For example the UK government aimed to invest £7 million between 2008 and 2011 in a programme of innovative campaigns to encourage people to walk more(14;15), and the US Department of Health and Human Services advocates walking as the principle component of its Active Living (16;17) initiative (one of seven priorities in the National Prevention Strategy) (18). And, as mentioned above, the World Health Organization physical activity recommendations include walking.

There have been three recent systematic reviews evaluating the effectiveness of walking groups to enhance health (19) and increase physical activity (20;21) They included 42 studies (19), 19 studies (20) and 10 studies (in the led walks section) (21) and all have strengths and weaknesses. For example, two (19;20) included both randomised and non-randomised studies but the other (21) included RCTs only. All three included studies with physically and/or mentally healthy participants and studies with participants with a variety of

physical conditions that may impede walking (such as knee osteoarthritis), and did not meta-analyse results for different participant groups separately. Also studies included in earlier systematic reviews were not included in later systematic reviews. One (20) included more than one effect size estimate per study, thus double counting results from some participants. One (21) did not conduct meta-analyses and one (19) had a physical functioning (6 minute walk test) meta-analysis of two included studies in non-healthy patients. None of the reviews looked at the specific impact that being part of a group had on adherence to the intervention.

This systematic review evaluates the effectiveness in physically healthy adults of walking in groups compared to inactive controls and/or individuals walking alone, focusing on any measure of physical activity or quality of life at follow up. By also including walking alone as a comparison group we examine whether being part of a group is more likely to lead to greater benefits than walking alone.

Methods

We developed and registered a protocol for this systematic review (Prospero registration number CRD 42016033752). The pre-defined inclusion criteria were comparative group studies in any language with physically healthy adults taking part in led walks or community group walks with an aspect of social interaction in addition to walking. We defined physically healthy as free from reported physical conditions or pain that would impede walking. We accepted a maximum of 20% in any group with pre-existing physical conditions so as not to exclude useful information, because many participants were likely to be older and not all would be completely physically healthy. Any forms of walking groups were compared to either (a) standard care, waiting list or any other non-active interventions such as physical activity advice or lectures on diet or nutrition (Set 1), or (b) walking alone (Set 2). Outcomes of interest were any measure of physical activity at follow up and/or any measure of generic quality of life or wellbeing. Outcomes could be measured at any time at or after the end of the intervention.

The following databases were searched between 2010 and March 2016: Medline, Embase, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane Central and Web of Science, Science Citation Index. Search terms included walk*, groups, program*, club, community, healthy, physical activity and exercise. Both MESH terms and keywords were used (see Supplementary Table 1). Search terms were piloted to ensure that searches were sufficiently sensitive to find known includeable studies. Reference lists of included studies and systematic reviews (19-21) were checked for includeable studies. Since there had been three relevant published systematic reviews with very comprehensive searches, with dates up to 2011-12, our searches were started in 2010 in order to ensure no studies were missed during the overlapping period. All relevant titles and abstracts were transferred to Endnote for assessment.

Two reviewers (CM and JE) checked study eligibility independently. Both also independently extracted data from studies into standardised, pre-designed extraction tables in Microsoft Word. Disagreements were resolved through discussion. Quality of included studies was assessed using likelihood of selection, performance, attrition and detection criteria because of the variety of study designs included. Specific quality checklists evaluate these biases tailored to different study designs and as we had a variety of study designs included, going back to fundamental quality assessment was considered to be more useful than using a mixture of different checklists. We tabulated the characteristics and results of all the included studies; analysis was quantitative. Numerical results were presented as point estimates of effect sizes (means, medians) with any reported measures of spread (standard deviations,

standard errors, ranges, confidence intervals). Where standard errors, ranges or 95% confidence intervals (95%CI) were provided, standard deviations were calculated using standard formulae from the Cochrane Handbook (22). Review Manager (version 5.3, The Cochrane Library) was used for meta-analyses. Where medians and ranges were given, these were only converted into means and SDs if the ranges were not skewed. We used random effects models because of heterogeneity of participants, interventions and outcome measures of physical activity. Where categorical measures were reported, meta-analyses used odds ratios (OR). Most outcomes, however, were continuous measures, and we used standardised mean differences (SMD) as outcomes had differing measurement scales. In one of the continuous outcome measures, a lower score was a better result (time taken to walk one mile) so these results were reversed for the meta-analysis. Several of the studies had more than one measure of physical activity, so we conducted two continuous measures meta-analyses, one using the lowest values (smallest effect size) and one using the highest values (largest effect size). Where only one measure of physical activity was reported this is used in both meta-analyses. There was insufficient evidence to warrant further investigation of heterogeneity by meta-regression. Risk of publication bias was assessed using a funnel plot.

Role of the funding source

There was no funding source for this study. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

Searches found 1404 titles and abstracts. After removing duplicates 1047 remained for screening, of which 1000 were excluded. Full papers for 79 articles were assessed for inclusion (47 from database searches and 32 from reference lists) (see Supplementary Figure 1). For a full list of excluded studies and reasons for exclusion, see Supplementary Table 2. There were 18 studies included in the qualitative synthesis, fourteen used an inactive control (Set 1) (23-36) and four compared group walking interventions to walking alone (Set 2) (37-40). One study from Set 1 (30) had a second publication reporting long-term follow up (41). There were 10 studies from Set 1 in the quantitative syntheses (meta-analyses). It is possible that there might be an effect from publication bias suggesting that small trials with no significant effects have not been published, or their physical activity results not published (see Supplementary Figure 2).

Characteristics of included studies are presented in Supplementary Table 3. The majority of studies (14 out of 18) were RCTs or cluster RCTs; there was also one non-randomised experimental study (36), two case-control (38;39) and one cohort study with a local population comparator (29). The number of participants in studies varied between 17 and 605 participants; seven of the studies had fewer than 50 participants. Most studies included older participants (older than 65 years) but participants' ages ranged from 18 to 91 years. Participants were community volunteers in eight studies (23;24;26;32-34;36;37), recruitment was via general practices or community centres in six studies (25;27;31;35;38;40), from specific housing areas in two studies (29;39) and from random population sampling in one study (28). In the remaining study the recruitment method was unclear (30). The interventions were all led walks or walking in groups. In some studies the intervention consisted of encouraging participants to walk in a group, facilitated by advertising locally and training an individual to lead the walks, in others the intervention entailed leading the group in the walks. Interventions studied lasted between five and 90 minutes on one to seven days per week, for between eight weeks and one year. The frequency and duration of walking was tailored to the ages of the sample participants.

The comparators in Set 1 were usual activities, cancer screening, fitness testing, advice, educational lectures, no walking group encouragement, waiting list, no intervention routine care or unspecified inactive controls. The comparators in Set 2 were usual care with encouragement to walk but no access within the study to a walking group (27;28), being a former walking club member but still walking (39), and not being paired with a 'buddy' to walk with (40). Follow-up was at the end of the intervention only for most of the studies, three studies had additional follow ups at between 3 months and 10 years (23;27;30). One case

control study (39) had no follow-up as the comparator was retrospective. Outcomes measured were of a wide variety of categorical and continuous physical activity measures; no study used the same physical activity measure.

Quality of included studies varied (see Supplementary Table 4); nine studies were classified as being at high risk of bias, five medium and four low risk of bias. A number of the studies gave insufficient details to assess all aspects of quality so classification may not be accurate. An intervention such as this cannot be blinded to the participant, but blinding of investigators and outcome assessment should have been possible but it was not apparent whether this had been done in the majority of the studies (24-26;28;33-35;36;38-40). For the cluster RCTs, in Thomas et al 2012 (40) it was clear that participants knew they were part of a trial whereas in Fisher et al 2004 (24) and Jancey et al 2008 (28) this was unclear.

Physical activity outcomes

Numerical results are shown in Table 1. For Set 1 (inactive controls), meta-analysis of the continuous measure of physical activity showed that walking in groups increased physical activity at follow up compared to inactive controls (9 RCTs, highest value SMD 0.58 (95%CI 0.34 to 0.82, I^2 = 76%) and lowest value SMD 0.43 (95%CI 0.20 to 0.66, I^2 = 73%)) (see Figure 1a and 1b). Removing the non-randomised experimental study (Takahashi 2013) reduced the SMD from 0.58 (95%CI 0.34 to 0.82) to 0.51 (95%CI 0.28 to 0.74). When the two studies that undertook follow up beyond the end of the intervention (22 months and 3.5 months after participating in intervention) (Isaacs 2007, Kriska 1986) are taken out of the lowest value meta-analysis, the SMD increases from 0.43 (95%CI 0.20 to 0.66) to 0.66 (95%CI 0.30 to 1.02) suggesting that physical activity gains associated with participating in walking groups diminished over time. Two studies measured categorical outcomes for physical activity. The meta-analysis found that the risk of participants being physically active at the end of the intervention was significantly higher in the intervention group compared to the comparators (RR 1.44 (95%CI 1.22 to 1.70, I^2 = 0%)) (Supplementary Figure 3).

For Set 2 (walking alone controls) studies were too few and too heterogeneous to conduct meta-analysis. For Cox 2008, there was no difference in 1.6km walk time between intervention and control groups at both 6 months and 1 year follow-ups. In Lee 2011, exercise frequency and duration were statistically significantly improved for the intervention group compared to controls at the end of the intervention (12 weeks). For Nguyen 2002 (39), there was a higher percentage of participants walking 1 km or less in the intervention group compared to the controls. In Thomas 2012 (40), those receiving the buddy intervention had higher mean physical activity levels at 12 months than controls, although the numerical

results for the control group were not explicitly reported.

Quality of life outcomes

Seven of the Set 1 and none of the Set 2 studies measured quality of life and wellbeing (see Table 2). Studies used a variety of measures for quality of life and wellbeing including Euroqol EQ-5D, Nottingham Health Profile (NHP), SF-36 and SF-12. All scores except NHP had higher scores indicating better quality of life. For NHP higher scores indicated greater number and severity of problems. In five of the seven studies (24-26,32;33), the walking group intervention groups showed statistically significantly improved scores compared to controls in at least one of the outcomes measured. In the remaining two studies (27;35) there were no significant differences found, including in NHP scores. None of the outcomes measured showed significantly worse quality of life or wellbeing for the walking group interventions compared to controls.

Other outcomes

Retention rates are shown in Supplementary Table 4 and include retention rates for all participants, or retention rates by group where reported. Ten of the studies reported retention rates separately for the intervention groups compared to controls (eight in Set 1 and two in Set 2). Seven had higher rates for the intervention groups whereas three had higher rates for the control groups. In several instances the rates were very similar. Many of the studies found that retention rates dropped gradually over time. There was insufficient information to determine whether different types of control had any impact on retention rates.

Three studies in Set 1 and no studies in Set 2 reported numerical results for measures of social network or sociableness. Jancey 2008 (28) used a categorical measure of 'Having no friends nearby' in Generalised Estimating Equations and found that it had a significant negative effect (p=0.037) on total physical activity times, suggesting that fewer friends nearby was correlated with less total physical activity. Krieger 2009 (29) measured the number of neighbours the participant knew well enough to say hello to. They reported before and after results for the intervention group only and found a significant increase in the mean number of neighbours that participants knew well enough to say hello to while walking (4.3 (95%CI 2.0, 6.7) p=0.001). Maki 2012 (32) measured the Lubben Social Network Scale and found that there was no significant difference in mean scores between the intervention and control groups (16.3 (SD5.7) versus 16.8 (SD5.2) p=0.16).

Discussion

Main findings

The main finding was that physical activity in physically healthy adults improved at follow up for the walking group intervention compared to inactive controls. This is based mostly on self-report physical activity outcomes and only one study used accelerometry (36) but this study was small, with 14 participants in each group. This physical activity improvement was strongest immediately following completion of the intervention and reduced somewhat at longer follow-ups. Walking in groups tended to increase quality of life measures and may increase social connectedness, but the evidence for this was uncertain. There was insufficient evidence to indicate whether walking in groups was more effective than walking alone for increasing physical activity and no evidence on the impact on quality of life.

Retention rates tended to be higher in the intervention groups. No included study reported the proportion of participants meeting the recommended guidelines for physical activity of 30 minutes moderate intensity physical activity five times per week (42). In general the quality of the evidence found was mixed, with seven out of 13 studies in Set 1 and two out of four studies in Set 2 considered to be at high risk of bias.

Comparison to previous work

Previous systematic reviews found that walking groups, compared to a variety of active and inactive controls provided wide-ranging health benefits (19) and that they were effective in increasing physical activity (20), including for leisure and travel (21). However, this is the first systematic review to quantify this effect in physically healthy people compared to inactive controls through meta-analyses. Also, this is the first systematic review to attempt to compare the sociable side of walking in groups to people walking alone.

Strengths and limitations

This systematic review has several strengths in that it is both more comprehensive than previous systematic reviews as it included adult participants of any ages, and more focussed as it only included mainly physically healthy participants, rather than mixing participants with conditions likely to impede the ability to walk such as knee arthritis with participants without such difficulties. In the included studies, participants varied but were mostly older adults, particularly older women and it is women in the age group of 55 to 74 year olds that form the majority of walkers in walking groups (43). As many participants were older, not all will be completely physically healthy, so a pragmatic decision was made to limit the proportion of physically unhealthy participants in any group to 20% or less, so as not to exclude useful

information. Extensive searches of reference lists from previous systematic reviews, included studies and policy documents were made, in addition to database searches, to find all eligible studies. All included studies were listed in one or more of the three systematic reviews (19-21). It is clear from the fact that the previously published systematic reviews (19-21) were not comprehensive that searching for these types of studies is not straightforward. One reason is that, when searching for studies, the term 'walking group' can refer to one arm of a comparative study rather than where people were walking in groups. Therefore a relatively large number of full texts were read thoroughly to ascertain the exact nature of the walking intervention and whether it had any kind of social interaction. Physical activity interventions are difficult to search for via databases alone, for example another systematic review of physical activity interventions found twice as many studies via other sources than via database searches (44). Also definitions of physical activity, exercise and physical fitness can vary so in this paper we use descriptions defined by Caspersen in 1985 (45).

There were some studies where full papers were unavailable that could have been includeable in the systematic review. Every effort was made to use all available data including extracting information from existing systematic reviews. The included studies were very heterogeneous in terms of participants, interventions, comparators, follow up lengths and study designs, so it could be argued that studies should not have been meta-analysed. Also, some studies had imbalances at the start of the study, for example the cluster RCT by Jancey et al 2008 (28). However, random effects models were used to mitigate these factors to some extent, but this gives more weight to smaller studies than fixed effects meta-analysis. Given that most of the included studies were relatively small this weighting may be a strength rather than a weakness. We included any comparative studies rather than RCTs only, and it could be argued that the different study designs should not have been meta-analysed. Also no two physical activity outcomes were the same. Most were by self-report which can be inaccurate, few used objective measures and only one used accelerometry(36). However, they were all measuring physical activity in some way which meant that they could be meta-analysed. This approach assumes that a standard deviation change in one physical activity measurement scale is equivalent to a standard deviation change on another, which may not be true. Some numerical results were missing which meant that not all studies could be entered in the meta-analyses. We had to estimate SD from other measures of spread in three studies (26;27;31) but in one other (29) there was no measure of spread given so it could not contribute to the meta-analysis result. Because of all these factors, we consider our meta-analyses exploratory, and we conducted sensitivity analyses by altering the physical activity outcomes entered into the meta-analyses to generate highest and lowest effect size estimates.

We did not include the time spent in physical activity in the meta-analyses, although this is reported in Tables 1a and 1b. It might be that longer walking duration is a better predictor of physical activity outcomes, and this could be established through meta-regression. However, we chose not to conduct meta-regression because of the wide variation in physical activity outcome measures used in the included studies, and because there were only nine studies that could contribute to the calculation. In addition, some of the studies included warming up and cooling off, whereas others did not report this. These times are often opportunities for social interaction, which would not be captured if duration of exercise was used only. Social connectedness outcome measures were not well reported and the measures used not well validated.

Implications for policy

This systematic review aims to inform public policy on group walking promotion. As high levels of moderate intensity physical activity (60 to 75 minutes per day) seem to eliminate any increased risk of death associated with lack of physical activity, the more that people can be encouraged to undertake physical activity, the better it will be for them, the health services and the public purse (46;47). The lack of strong evidence demonstrating that group walking participation enhanced physical activity compared to walking alone means that there is no strong driver as yet for governments to adopt coherent strategic plans or to invest in this area of physical activity behaviour change. Walking in groups is a safe and inexpensive intervention that can be delivered easily and successfully in the community and has consistency with expectations and the public's perception of walking.

Implications for research

There needs to be further research clearly evaluating the benefits for physically healthy people in taking part in group walking compared to walking alone, particularly measuring physical activity over the longer term. The activity measure should be that recommended by the World Health Organisation, i.e. the proportion meeting the physical activity guidelines. Other outcomes should include generic quality of life and wider societal costs. Capturing any adverse events is also important. There also needs to be evaluation of the best ways to motivate people to continue with walking once the initial enthusiasm wanes and the officially organised activity is discontinued. It is possible that sociable aspects of group walking may enhance persistence in maintaining physical activity participation.

There needs to be encouragement to the physical activity research community to standardise physical activity measurement (following the COMET initiative (48)), so that all studies measure physical activity consistently. This would enable results of various

interventions to be compared across studies.

Conclusions

The bulk of the empirical evidence base for walking in groups consists of small studies comparing this activity to inactive controls and there is good evidence that walking in groups is more effective than inactivity. However, there is far less evidence on walking in groups compared to walking alone, yet research has shown that exercise adherence is enhanced through the use of social support. At a time when we are being encouraged to meet physical activity guidelines, a large proportion of the public fail to do so. Better quality evidence may encourage government policy to promote walking in groups organised by the groups themselves. Adequately powered multi-centre RCTs along with qualitative process evaluation should be undertaken to test the efficacy of walking group encouragement interventions.

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Figure files

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Supplement

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Supplementary Table 2. List of excluded full text papers with reasons for exclusion

Supplementary Table 3. Characteristics of included studies

Supplementary Table 4. Quality assessment

Supplementary Figure 1. PRISMA flow diagram

Supplementary Figure 2. Funnel plot

Supplementary Figure 3. Meta-analysis of categorical physical activity outcomes

(IJTAHC 17-029 Walking Groups. Meads Exley.)

Table 1. Numerical physical activity results

Study	Intervention N	Control N	Physical activity measure	Follow up 1		Follow up 2 (if reported)	
				Intervention	Control	Intervention	Control N
Inactive controls							
Avila 1994[@]	N=22	N=22	Exercise frequency	NR*	NR*	NR	NR
Hamdorf 1999	N=18	N=20	Maximum current activities (Mean (SE)), ie highest current activity	72.3 (1.82)* (SD 7.72)#	61.3 (2.07)* (SD 9.26)#	N/A	N/A
Isaacs 2007	N=300	N=305	Minutes of MVPA (Adjusted geometric mean relative to baseline (95%CI))	89 (95%CI 75-106) (SD 136.97)#	58 (95%CI 49-69) (SD 89.10)#	128 (95%CI 109-151)	NR
			Total minutes of activity, (Adjusted geometric mean relative to baseline(95%CI))	759 (703-820) (SD 516.96)#	647 (600-699) (SD 441.06)#	907 (95%CI 841-977)	NR
			Energy expenditure per week (Adjusted geometric mean relative to baseline (95%CI))	42 (39-45) (SD 26.51)#	35 (33-38) (SD 22.28)#	49 (95%CI 45-52)	NR
Jancey 2008	N=177	N= 236	Total physical activity times (Mean (SD))	6.20 (5.01)	5.29 (6.19)	N/A	N/A
Krieger 2009	N= 53	N= 155	Minutes walked per day (Mean (SD))	108.8 (NR)	64.2 (NR)	N/A	N/A
			Minutes walked per day for exercise, (Mean (SD))	51.0 (NR)	26.7 (NR)	N/A	N/A
			Percentage doing moderate activity at least 150mins/week	80.8%	56.3%	N/A	N/A
Kriska 1986 (Pereira 1998)	N=114	N=115	Blocks (urban environment) walked daily (Mean (SD))	15.54 (11.01)*	10.56 (9.33)*	16.33 (9.88)*	9.56 (8.76)*
			Flights of stairs climbed/day (Mean (SD))	9.91 (7.36)	9.6 (9.86)	9.22 (7.71)	8.94 (6.23)
			LSI Activity Monitor day count/hr (Mean	47.32 (35.47)*	37.22 (22.96)*	47.16 (29.47)*	37.46

Study	Intervention N	Control N	Physical activity measure	Follow up 1		Follow up 2 (if reported)	
				Intervention	Control	Intervention	Control N
			(SD))				(21.14)*
			LSI Activity Monitor evening count/hr (Mean (SD))	25.8 (19.83)	22.16 (17.33)	24.88 (22.85)	24.88 (28.96)
Lamb 2002	N=95	N=93	Numbers active	20 (21.1%)	20 (21.5%)	37 (38.9%)	25 (28.9%)
			Walking mins/wk (Median (IQR))	60 (0-120)	30 (0-150)	60 (0-197.5)	60 (0-180)
			Walking sessions/wk (Median (IQR))	2.5 (0-6)	2 (0-3)	4.0 (0-8) (SD 6)#	2.5 (0-6) (SD 4.5)#
Maki 2012	N=66	N=67	Life space assessment questionnaire (Mean (SD))	101.1 (15.4)	95.9 (18.0)	N/A	N/A
			Average number of pedometer steps (Mean (SD))	7044 (2891)*	4940 (2552)*		
Palmer 1995	N=16	N=11	Mile walk times (NB lower number better) (Mean (SD))	17.6 (0.6)	19.7 (1.8)	N/A	N/A
Resnick 2002	N=10	N=7	Exercise activity (total number of hours) (Mean (SD))	14.1 (9.6)*	0.0 (0.0)*	N/A	N/A
			Overall activity (kcals per week) (Mean (SD))	31.9 (19.4)	18.4 (15.4)	N/A	N/A
Takahashi 2013	N=14	N=14	MVPA (by accelerometer) not on WG days(Mean (SD))	165.2 (20.4)	136.6 (16.9)	N/A	N/A
			MVPA (accelerometer) (Mean (SD))	235.5 (14.3)	136.6 (16.9)	N/A	N/A
Walking alone controls							
Cox 2008	N=27	N=22	1.6km walk time (NB lower number better)	13.91 (SD=1.02)	13.77 (SD=0.94)	14.17 (1.03) (N=22)	13.57 (1.01) (N=20)
Lee 2011	N= 22	N=27	Exercise duration (mins/day)	66.0 (NR)*	45.24 (NR)*	N/A	N/A
			Exercise frequency (times/wk)	4.27 (NR)*	3.78 (NR)*	N/A	N/A
Nguyen 2002	N= 267	N=236	Percentage walking 1 km or less	82.8%	50.0%	N/A	N/A
Thomas 2012	N=193	N=206	Physical activity/ fitness (IPAQ 1000 MET minutes per week) (differences in means compared to controls)	1.26 (95%CI=0.78 to 1.74)	(group results NR)	N/A	N/A

Study	Intervention N	Control N	Physical activity measure	Follow up 1		Follow up 2 (if reported)	
				Intervention	Control	Intervention	Control N
* p=0.05 or less, # estimated values for SD, @ details from Blank et al (2012) (21). Abbreviations: CI – confidence interval, IPAQ – International Physical Activity Questionnaire, IQR – inter-quartile range, kcal – kilocalories, km – kilometre, LSI – Large Scale Integrated, MET – metabolic equivalent, mins – minutes, MVPA – moderate or vigorous physical activity, NB – *nota bene*, NR – not reported, N/A - not applicable, SD - standard deviation, SE – standard error, WG – walking group, wk – week,							

(IJTAHC 17-029 Walking Groups. Meads Exley.)

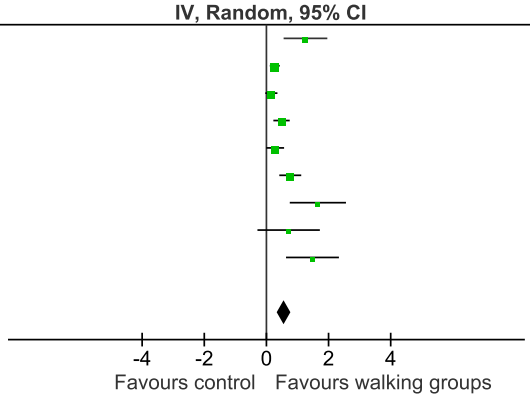
Table 2. Quality of life and wellbeing results (all self-report)

Study	Intervention N	Control N	Quality of life measure	Intervention	Control	Significance testing
Fisher 2004	N= 224	N=358	SF-12 physical	72.32 (28.49)	62.90 (25.55)	p<0.001
			SF-12 mental	72.46 (23.86)	66.99 (24.07)	p<0.05
			Satisfaction With Life scores	16.05 (3.69)	15.16 (3.77)	p=0.05
Gusi 2008	N=55	N=51	Anxiety/depression by EQ-5D (mean (SD))	1.2 (0.4)	1.4 (0.6)	p=0.009
			EQ-5D (mean (SD) ANCOVA and adjusted for baseline)	0.890 (0.178)	0.510 (0.196)	NR
Hamdorf 1999	N=18	N=20	Nottingham Health Profile at 6 months	NR	NR	p=NS
			Modified Philadelphia Geriatric Centre Morale scale (mean (SE))	9.9 (0.38)	7.8 (0.58)	p=0.002
Isaacs 2007*	N=300	N=305	SF-36 (mean (SD))	0.75 (0.14)	0.75 (0.14)	p=NS
			Euroqol questionnaire	NR	NR	No differences between treatment groups or between during the trial and follow-up
Maki 2012	N=75	N=75	Satisfaction in Daily Life questionnaire	45.3 (4.4)	44.5 (5.8)	Before-after interaction p=0.002
Moore-Harrison 2008	N=12	N=12	SF-36 physical functioning (mean (SD))	85.8 (13.6)	69.6 (18.3)	p=0.014
			SF-36 role-physical (mean (SD))	81.3 (21.7)	85.4 (16.7)	p=NS
			SF-36 bodily pain (mean (SD))	69.3 (25.2)	61.9 (19.7)	p=NS
			SF-36 general health (mean (SD))	74.8 (13.1)	74.3 (11.8)	p=NS
			SF-36 vitality (mean (SD))	66.7 (15.1)	66.3 (12.6)	p=NS
			SF-36 social functioning (mean (SD))	89.6 (14.9)	92.7 (15.5)	p=NS
			SF-36 role-emotional (mean (SD))	83.3 (33.3)	88.9 (21.7)	p=NS
			SF-36 mental health (mean (SD))	82.0 (12.9)	87.3 (6.8)	p=NS
Resnick 2002	N=10	N=7	SF-12 physical health (mean (SD))	47.0 (5.2)	46.8 (3.2)	p=NS
			SF-12 mental health (mean (SD))	33.4 (4.8)	31.2 (4.9)	p=NS

* Follow up 2 reported for intervention group only N=300, SF-36 mean (SD) = 0.77 (0.15), Abbreviations: EQ-5D – Euroqol 5 Dimensions, NR – not reported, NS – no significant difference between groups, SD – standard deviation, SE – standard error, SF – short form
Scale ranges – SF-12 - range 0 to 100 for physical and mental health components, where a zero score indicates the lowest level of health and 100 indicates the highest level of health. Satisfaction with Life – range 5 to 35, with a score of 20 representing neutral and between 5-9 indicating extreme dissatisfaction with life, and between 31-35 indicating extreme satisfaction. EQ-5D (Euroqol) – range 0 to 1 where 0 is death and 1 is perfect perceived health. Nottingham Health Profile – range 2 to 200 where the higher the score, the greater the number and severity of problems. Modified Philadelphia Geriatric Centre Morale scale - range 0 to 17 where a higher score indicates higher morale, Satisfaction in Daily Life – range unavailable but higher score indicates better quality of life, SF-36 - - range 0 to 100 for eight scales where a zero score indicates the lowest level of health and 100 indicates the highest level of health

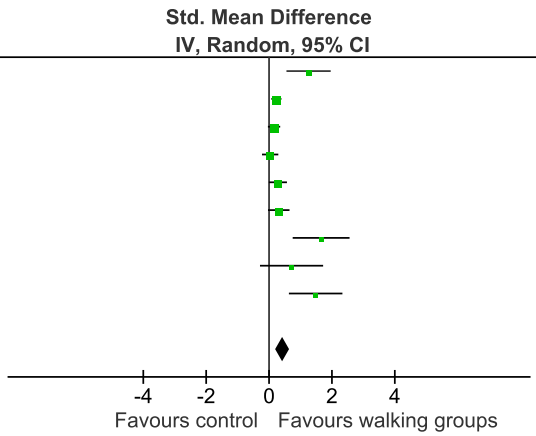
Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Hamdorf 1999	72.3	7.72	18	61.3	9.26	20	7.2%	1.26 [0.55, 1.96]
Isaacs 2007	89	137	300	58	89	305	17.3%	0.27 [0.11, 0.43]
Jancey 2008	6.2	5.01	177	5.29	6.19	236	16.7%	0.16 [-0.04, 0.35]
Kriska 1986	15.54	11.01	114	10.56	9.33	115	15.3%	0.49 [0.22, 0.75]
Lamb 2002	4	6	95	2.5	4.5	93	14.8%	0.28 [-0.01, 0.57]
Maki 2012	7,044	2,891	66	4,940	2,552	67	13.4%	0.77 [0.41, 1.12]
Palmer 1995	19.7	1.8	11	17.6	0.6	16	5.2%	1.66 [0.75, 2.56]
Resnick 2002	31.9	19.4	10	18.4	15.4	7	4.4%	0.72 [-0.29, 1.72]
Takahashi 2013	165.2	20.4	14	136.6	16.9	14	5.6%	1.48 [0.63, 2.33]
Total (95% CI)			**805**			**873**	**100.0%**	**0.58 [0.34, 0.82]**

Heterogeneity: Tau² = 0.08; Chi² = 32.93, df = 8 (P < 0.0001); I² = 76%
Test for overall effect: Z = 4.74 (P < 0.00001)



Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Hamdorf 1999	72.3	7.72	18	61.3	9.26	20	6.8%	1.26 [0.55, 1.96]
Isaacs 2007	759	517	300	647	441	305	17.8%	0.23 [0.07, 0.39]
Jancey 2008	6.2	5.01	177	5.29	6.19	236	17.1%	0.16 [-0.04, 0.35]
Kriska 1986	9.91	7.36	114	9.6	9.86	115	15.6%	0.04 [-0.22, 0.29]
Lamb 2002	4	6	95	2.5	4.5	93	14.9%	0.28 [-0.01, 0.57]
Maki 2012	101.1	15.4	66	95.9	18	67	13.6%	0.31 [-0.03, 0.65]
Palmer 1995	19.7	1.8	11	17.6	0.6	16	4.8%	1.66 [0.75, 2.56]
Resnick 2002	31.9	19.4	10	18.4	15.4	7	4.1%	0.72 [-0.29, 1.72]
Takahashi 2013	165.2	20.4	14	136.6	16.9	14	5.3%	1.48 [0.63, 2.33]
Total (95% CI)			**805**			**873**	**100.0%**	**0.43 [0.20, 0.66]**

Heterogeneity: Tau² = 0.07; Chi² = 29.71, df = 8 (P = 0.0002); I² = 73%
Test for overall effect: Z = 3.70 (P = 0.0002)



A systematic review of group walking in healthy people to promote physical activity – -Supplement.

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Contents:

Supplementary Table 1. Search terms and searches

Searches were conducted in March 2016 for the years 2011-2016 to find relevant studies. Medline, Embase, PsychInfo, CAB Abstracts, Cochrane Central, and Web of Science, Science Citation Index were searched. Also many relevant studies would have been included in at least one of the three recent systematic reviews on walking interventions, so the included and excluded studies lists of these reviews were examined, using full texts if necessary to establish whether they met our inclusion criteria. The searches for these reviews were dated • Kassavou SR searches to March 2012 • Hanson SR searches to November 2013 • ScHARR searches not given but presumed to be to end 2011
Medline (OVID) search terms: (Walk*) AND (program* or group* or led or scheme* or club* or community-based) AND (Healthy Volunteers/ or healthy.mp. or Healthy People Programs/) AND (physical activity or exercise) Searches were limited to: human, all adults, therapy (maximises sensitivity)

Supplementary Table 2. List of excluded full text papers with reasons for exclusion (n=61)

Study	Reason for exclusion
Anton SD, Duncan GE, Limacher MC et al. How much walking is needed to improve cardiorespiratory fitness? An examination of the 2008 Physical Activity Guidelines for Americans. Research Quarterly for Exercise and Sport 2011; 82(2):365-70	Not WG intervention
Armstrong K, Edwards H. The effectiveness of a pram-walking exercise programme in reducing depressive symptomatology for postnatal women. International journal of Nursing Practice 2004;10:177-194	No PA outcomes given
Asikainen T-M, Miilunpalo S, Oja P et al. Randomised controlled walking trials in postmenopausal women: the minimum dose to improve aerobic fitness? British journal of Sports Medicine 2002;36:189-94	Not WG intervention
Baker G, Gray SR, Wright et al. The effect of a pedometer-based community walking intervention "Walking for Wellbeing in the West" on physical activity levels and health outcomes: a 12-week randomised controlled trial. International Journal of Behavioural Nutrition and Physical Activity 2008;5(44):1-15	Not WG intervention
Banks-Wallace J. Outcomes from the Walk the Talk: a nursing intervention for Black women. The ABNF Journal 2007 Winter.	Pre-post design
Becofsky KM, Sui X, Lee DC, *et al.* A prospective study of fitness, fatness, and depressive symptoms. American Journal of Epidemiology 2015: 181: 311–320.	Unavailable (PhD)
Bemelmans RH, Blommaert PP, Wassink AM et al. The relationship between walking speed and changes in cardiovascular risk factors during a 12-day walking tour to Santiago de Compostela: a cohort study. BMJ Open 2012; 2(3): e000875	No comparator group
Bergstrom I, Lombardo C, Brinck J. Physical training decreases waist circumference in postmenopausal borderline overweight women. Acta Obstetricia et Gynecologica Scandinavica 2009;88(3): 308-13	All have osteoporosis
Bird M, Hill KD, Ball M et al. The long-term benefits of a multi-component exercise intervention to balance and mobility in healthy older adults. Archives of Gerontology and Geriatrics 2011;52:211–6	Not WG intervention
Blain H, Tallon G, Jaussent A et al. Effect of exercise tolerance and fat mass of a 6-month brisk walking program in sedentary women aged 60 or older: results of a randomised trial. European Geriatric Medicine 2013;4:S20-80, p126	Conference abstract

Bocalini DS, Serra AJ, Murad N et al. Water- versus land-based exercise effects on physical fitness in older women. Geriatrics & Gerontology International 2008;8(4): 265-71	Not WG intervention
Borg P, Kukkonen-Harjula K, Fogelholm M. Effects of walking or resistance training on weight loss maintenance in obese, middle-aged men: a randomized trial. International Journal of Obesity 2002;26:676–83	Not WG intervention
Brandon LJ, Elliott-Lloyd MB. Walking, body composition and blood pressure dose-response in African American and white women. Ethnicity and Disease 2006;6:675-81	No PA outcomes given
Brousseau L, Wells GA, Kenny GP et al. The implementation of a community-based aerobic walking programme for mild-to moderate knee osteoarthritis: a knowledge translation randomised controlled trial: part II clinical outcomes. BMC Public Health 2012;12:1073	Participants have knee arthritis
Cheng SJ, Yang YR, Cheng FY et al. The changes of muscle strength and functional activities during aging in male and female populations. International Journal of Gerontology 2009;8(4): 197-202	Not WG intervention
Cooper AR, Kendrick A, Stansbie D et al. Plasma homocysteine in sedentary men: Influence of moderately intense exercise. Cardiovascular Reviews & Reports 2000;21(7): 371-374+380	Unavailable
Cox KL, Burke V, Beilin LJ et al. Blood pressure rise with swimming versus walking in older women: the sedentary women exercise adherence trial 2 (SWEAT 2). Journal of Hypertension 2006;24:307-14	Active control group (swimming)
Cox K, Kane E, Burke V et al. Long-term effects of 6-months of home-based physical activity and counselling on the mental health of older adults: The MOVES study. Journal of Science and Medicine in Sport 2011;14S: e1–e119 (29)	Conference abstract
Cyarto EV, Brown WJ, Marshall AL et al. Comparison of the effects of a home-based and group-based resistance training programme on functional ability in older adults. American Journal of Health Promotion 2008;23:13-7	Active control (resistance training)
Duncan J, Gordon NF, Scott CB. Women walking for health and fitness. JAMA 1991;266(23):3295-9	No PA outcomes given
Estabrooks PA, Bradshaw M, Dzewaltowski DA et al. Determining the impact of Walk Kansas: applying a team-building approach to community physical activity promotion. Annals of Behavioural Medicine 2008;36(1):1-12	No numerical results for comparator

Fantin F, Rossi A, Morgante S et al. Supervised walking groups to increase physical activity in elderly women with and without hypertension: effect on pulse wave velocity. Hypertension Research 2012; 35(10):988-93	Pre-post design
Figard-Fabre H, Fabre N, Leonardi A et al. Efficacy of Nordic walking in obesity management. International Journal of Sports Medicine 2011;32:407-14	No inactive control
Foulds HJ, Bredin SS, Warburton DE. The effectiveness of community based physical activity interventions with Aboriginal peoples. Preventive Medicine 2011;53(6): 411-6	Active control group (walk/running or running)
Foulds HJ, Bredin SS, Charlesworth SA et el. Exercise volume and intensity: a dose–response relationship with health benefits. European Journal of Applied Physiology 2014;114:1563–71	Not WG intervention
Garnier S, Gaubert I, Joffroy S et al. Impact of brisk walking on perceived health evaluated by a novel short questionnaire in sedentary and moderately obese postmenopausal women. Menopause-the Journal of the North American Menopause Society 2013;20(8): 804-12	No PA outcomes
Hamdorf PA, Withers RT, Penhall RK et al. Physical training effects on the fitness and habitual activity patterns of elderly women. Archives of Physical Medicine and Rehabilitation 1992;73(7): 603-8	Unavailable
Heydarnejad S, Dehkordi AH. The effect of an exercise program on the health-quality of life in older adults. A randomized controlled trial. Danish Medical Bulletin 2010;57(1): A4113	Not WG intervention
Hincklemann LL, Nieman DC. The effects of a walking programme on body composition and serum lipids and lipoproteins in overweight women. Journal of Sports Medicine & Physical Fitness 1993;33:49-58	Unavailable
Hogue PA. The effects of buddy support on physical activity in African American women. University of Toledo, USA, 2007	Unavailable (PhD)
Hunter R. Tully M, Davis M et al. The 'Physical Activity Loyalty Card Scheme': A RCT investigating the use of incentives to encourage physical activity. Journal of Science and Medicine in Sport 2012;15:S328–S362	Not WG intervention
Ijuin M, Sugiyama M, Sakuma N et al. Walking exercise and cognitive functions in community-dwelling older adults: preliminary results of a randomised controlled trial. International Journal of Geriatric Psychiatry 2013;28:109-10	No PA outcomes
Izumi BT, Schultz AJ, Mentz G et al. Leader behaviours, group cohesion and participation in a walking group program. American Journal of Preventive Medicine 2015;49(1):41-9	No numerical results

Josula LK. Examination of physical activity for health promotion, and attitudes towards aging, among adults - cross-cultural comparisons; healthcare provider recommendations; toolkit evaluation. Dissertation Abstracts International: Section B: The Sciences and Engineering 2011;71(7B):4208	Unavailable (PhD)
Lautenschlager NT, Goh A, Etherton-Beer C et al. The indigo study: A randomized controlled trial of physical activity with individual goal-setting and volunteer mentors to overcome sedentary lifestyle in older adults at risk of cognitive decline. Alzheimer's and Dementia 2014;10:P124	Conference abstract
Lee RE, O'Connor DP, Smith-Ray R et al. Mediating effects of group cohesion on physical activity and diet in women of colour: health is power. American Journal of Health Promotion 2012;26(4):e116-25	Active control group (group meetings promoting good diet)
Lee RE, O'Connor DP, Smith-Ray et al. Mediating effects of group cohesion on physical activity and diet in women of colour: health is power. American Journal of Health Promotion 2006;26(4):e116-25	No PA outcomes
Lim, HJ. The effects of mode of walking exercise on cardiovascular disease risk factors and fitness level changes in the elderly. Unpublished master's thesis, Yonsei University, Seoul, Korea. 2008	Unavailable (MSc)
McAuley E, Courtenya KS, Rudolph DL et al. Enhancing exercise adherence in middle-aged males and females. Preventive Medicine 1994;23:498-506	Active control group (exercise including WG)
McAuley E, Blissmer B, Marquez DX et al. Social relations, physical activity and well-being in older adults. Preventive Medicine 2000;31:608-17	Active control group (stretching and toning for 6 months)
McAuley E, Jerome GJ, Elavsky S et al. Predicting long-term maintenance of physical activity in older adults. Preventive Medicine 2003;37:110-8	Active control group (stretching and toning for 6 months)
Minus-Grimes I, Frankson MA, Hanna-Mahase C. The impact of exercise on cognitive function in ambulatory elderly. American Geriatrics Society Annual Meeting 2013;S191:D24	Conference abstract
Mirghafourvand M, Mohammad Alizadeh Charandabi S, Nedjat S et al. Effects of aerobic exercise on quality of life in premenopausal and postmenopausal women: A randomized controlled trial. [Persian]. Iranian Journal of Obstetrics, Gynecology and Infertility 2014;17(114): 19-26	Unavailable
Negri C, Bacchi E, Morgante S, et al. Supervised walking groups to increase physical activity in type 2 diabetic patients. Diabetes Care. 2010;33(11):2333-5.	All participants have Diabetes Mellitus

Ozsahin AK, Bozkirli E, Bakiner OS et al. Compliance to walking type exercise among obese women without comorbidities. Turkiye Klinikleri Journal Medical Science 2013;33(3):814-9	Not WG intervention
Pahor M, Blair SN, Espeland M, et al. Effects of a physical activity intervention on measures of physical performance: Results of the lifestyle interventions and independence for Elders Pilot (LIFE-P) study. Journals of Gerontology Series A Biological Science and Medical Science. 2006;61(11):1157-65 Ip EH, Church T, Marshall SA et al. Physical activity increases gains in and prevents loss of physical function: Results from the Lifestyle Interventions and Independence for Elders Pilot Study. The Journals of Gerontology: Series A: Biological Sciences and Medical Sciences 2013;68A(4): 426-32	Not WG intervention
Palliard T, Lafont C, Costes-Salon MC et al. Effects of brisk walking on static and dynamic balance, locomotion, body composition, and aerobic capacity in ageing healthy active men. International Journal of Sports Medicine 2004;25(7): 539-46	Not WG intervention
Park J-H, Miyashita M, Takahashi M et al. Effects of low-volume walking programme and vitamin E supplementation on oxidative damage and health-related variables in healthy older adults. Nutrition & Metabolism 2013;10(38):1-9	No PA outcomes reported
Park JH, Park H, Lim ST et al. Effects of a 12-week healthy-life exercise program on oxidized low-density lipoprotein cholesterol and carotid intima-media thickness in obese elderly women. Journal of Physical Therapy Science 2015;27(5): 1435-9	Not WG intervention
Parkkari J1, Natri A, Kannus P et al. A controlled trial of the health benefits of regular walking on a golf course. American Journal of Medicine 2000;109(2):102-8	Not WG intervention
Reger-Nash B, Bauman A, Cooper L et al. Evaluating community-wide walking interventions. Evaluation and Program Planning 2006;29:251-9	Not explicitly WG interventions
Rogers TM. Effectiveness of a walking club and self-directed physical activity programme in increasing moderate intensity physical activity among African American females. University of Oregon, USA. 1997	Unavailable (PhD)
Rooks DS, Ransil BJ, Hayes WC. Self-paced exercise and neuromotor performance in community-dwelling older adults. Journal of ageing and Physiological Activity 1997;5:135-49	Active control group (resistance training)
Rosenberg DE, Kerr J, Sallis JF et al. Promoting walking among older adults living in retirement communities. Journal of Ageing and Physical Activity 2012;20(3):379-94	Not WG intervention

Salesi M, Rabiee SZ, Shikhani-Shahin H et al. Effect of a Walking Program on Metabolic Syndrome Indexes in Non-athlete Menopausal Women during 8 Weeks. Journal of Babol University of Medical Sciences 2014;16(10):68-74	No PA outcomes
Song M-S, Yoo Y-K, Choi C-H et al. Effects of Nordic walking on body composition, muscle strength and lipid profile in elderly women. Asian Nursing Research 2013;7:1-7	No PA outcomes
Staten LK, Scheu LL, Bronson D et al. Pasos Adelante: The effectiveness of a community-based chronic disease prevention programme. Preventing Chronic Disease, Public Health Research, Practice and Policy.2005;2(1):1-11	Pre-post design
Tak EC, van Uffelen JG, Mai JM et al. Adherence to exercise programs and determinants of maintenance in older adults with mild cognitive impairment. Journal of Ageing and Physical Activity 2012;20(1):32-46	Active control group (low intensity activity programme)
Takeda N, Oka K, Sakai K et al. The effects of a group-based walking programme on daily physical activity in middle-aged and older adults. International Journal of Sport and Health Science 2011;9:39-48	Active control group (easy exercises).
Zoeliner J, Connell C, Powers A et al. Does a six-month pedometer intervention improve physical activity and health among vulnerable African Americans? A feasibility study. Journal of Physical Activity and Health 2010;7:224-31	Pre-post design

Supplementary Table 3. Characteristics of included studies

Study, (country)	Study design	Participants	Setting	Intervention (duration)	Comparator	Physical activity outcomes reported	Quality of life and wellbeing outcomes reported	Follow up lengths
Inactive controls								
Avila 1994 @ (USA)	RCT	Latina women aged 18 or more, >20% overweight	Community volunteers	WG – 20 mins on 1 day per week (+ diet modification) (8 weeks)	Weekly cancer screening education for 8 weeks and invited for weight control classes after study	Yes	No	9 weeks (1 week post intervention) and 3 months after end of intervention
Fisher 2004 (USA)	Cluster RCT	Sedentary or inactive adults aged 65 and over and able to walk without assistance	Community volunteers	WG – up to 60 mins on 3 days per week (6 weeks) plus Health education and information programme sent monthly	Health education and information programme sent monthly	No	Yes	6 months (end of intervention)

Study, (country)	Study design	Participants	Setting	Intervention (duration)	Comparator	Physical activity outcomes reported	Quality of life and wellbeing outcomes reported	Follow up lengths
Gusi 2008 (Spain)	RCT	Moderately depressed, obese or overweight elderly women mean (SD) ages 71 (5) in intervention and 74 (6) in control groups	GP referrals	WG – 50 mins 3 days per week (6 months)	Usual care and fitness testing	No	Yes	6 months (i.e. at end of intervention)
Hamdorf 1999 (Australia)	RCT	Healthy older women aged 79-91	Community volunteers	WG – 5 up to 25mins on 2 days per week (26 weeks)	Usual activities (waiting list after 6 months)	Yes	Yes	6 months (i.e. at end of intervention)
Isaacs 2007 (UK)	RCT	Adults aged 40-74 with cardiovascular risk factors (raised cholesterol or BP, obesity, smoking, diabetes (13%), family history)	GP referrals	WG –choice from easy to hard walks on 2-3 days per week (10 weeks)	Advice only then waiting list	Yes	Yes	6 months (i.e. 3½ months after end of intervention) 1 year (i.e. 9½ months after end of intervention)

Study, (country)	Study design	Participants	Setting	Intervention (duration)	Comparator	Physical activity outcomes reported	Quality of life and wellbeing outcomes reported	Follow up lengths
Jancey 2008 (Australia)	Cluster RCT	Reasonably healthy insufficiently active older people aged 65-74	Population sample from random invitation via telephone number	WG – 10 up to 45 mins on 2 days per week (6 months)	No WG	Yes	No	6 months (i.e. at end of intervention)
Krieger 2009 (USA)	Cohort with historical controls	Walking group volunteers from the housing community aged 18 - >65 yrs (mode 45-64)	Public housing development of diverse and low income residents	WG up to 1 hour on 5 days per week (depending on participant capacity) (3 months)	High Point Housing community	Yes	No	3 months (i.e. at end of intervention)
Kriska 1986 (Pereira 1998) (USA)	RCT	Post-menopausal women, aged 50-65, free from physical handicaps	Recruitment method unclear	WG up to 3 miles on 2 days per week, plus encouraged to walk on their own (8 weeks) then continuing social walking group encouragement	Unclear	Yes	No	1 year and 2 years after start of trial (i.e. 44 weeks and 96 weeks post intervention) 10 years (Pereira

Study, (country)	Study design	Participants	Setting	Intervention (duration)	Comparator	Physical activity outcomes reported	Quality of life and wellbeing outcomes reported	Follow up lengths
								1998)
Lamb 2002 (UK)	RCT	Adults aged 40-70 years, with no serious medical problems	Random sample from GP practice lists.	Physiotherapist advice plus WG attendance encouraged for 1 year, choice of walks in groups or alone/with own family and friends	Physiotherapist advice but no specific WG encourage-ment	Yes	No	6 months 1 year (i.e. at end of intervention)
Maki 2012 (Japan)	RCT	Adults aged 65-80 yrs, healthy but at risk of mental decline	Community volunteers	WG – 90 mins on 1 day per week (3 months)	Educational lectures on food, nutrition and oral care	Yes	Yes	3 months (i.e. at end of intervention)
Moore-Harrison 2008 (USA)	RCT	Adults aged over 60, (mean age 71.5 (SD 8.1)) free from any illnesses aggravated by exercise	Community volunteers	WG – 10 up to 40 mins on 3 days per week (16 weeks)	Nutrition education then waiting list	No	Yes	4 months (i.e. at end of intervention)

Study, (country)	Study design	Participants	Setting	Intervention (duration)	Comparator	Physical activity outcomes reported	Quality of life and wellbeing outcomes reported	Follow up lengths
Palmer 1995 (USA)	RCT	Premenopausal women aged 29-50 without significant health problems and not highly physically fit	Community volunteers	WG – 20 up to 50 mins per session. Number of sessions per week not reported. (8 weeks)	Waiting list	Yes	No	8 weeks (i.e. at end of intervention)
Resnick 2002 (USA)	RCT	Sedentary older women (mean age 87 (3.1) in intervention or 89 (4.5) in control groups with MMSE score less than 20 and able to walk 50 ft or more	Retirement community	WG or walking alone – 20 mins on 3 days per week. (6 months)	Routine care	Yes	Yes	6 months (i.e. at end of intervention)
Takahashi 2013 (Japan)	Experimental study	Older adults aged 65-78, mostly physically inactive	Community volunteers	WG – 30-60 mins on 2 days per week (12 weeks)	Control (unspecified)	Yes	No	12 weeks (i.e. at end of intervention)
Walking alone controls								

Study, (country)	Study design	Participants	Setting	Intervention (duration)	Comparator	Physical activity outcomes reported	Quality of life and wellbeing outcomes reported	Follow up lengths
Cox 2008 (Australia)	RCT	Healthy sedentary women aged 50-70 yrs	Community volunteers	WG 30 mins on 3 days per week (6 months) then behavioural intervention to continue exercise in groups (6 months)	WG 30 mins on 3 days per week (6 months), then usual care with newsletters encouraging walking (6 months)	Yes	No	6 months and 1 year (i.e. at end of intervention)
Lee 2011 (South Korea)	Case control	Healthy middle-aged obese women aged 30 to 60 years (mean age 45 (intervention) and 47 (control)).	Public health centre	WG 1 hr on 3 days per week (12 weeks)	Monthly group workshops on health education plus walking alone plus encouraging text messages	Yes	No	12 weeks (i.e. at end of intervention)

Study, (country)	Study design	Participants	Setting	Intervention (duration)	Comparator	Physical activity outcomes reported	Quality of life and wellbeing outcomes reported	Follow up lengths
Nguyen 2002 (Canada)	Case control	Walking club members (mean age 54.6 (11.2)) and former walking club members (mean age 54.5 (11.7))	Community walking clubs	Current walking club members	Former walking club members	Yes	No	Not applicable
Thomas 2012 (Hong Kong)	Cluster RCT	Healthy people in community centres aged over 60 yrs	Community centres for older people	1. Pedometer – extra 3500 steps per day on 3-25 days/week 2. Buddy support – 30 mins on 3-5 days per week with a partner (12 months)	1. No pedometer 2. No buddy support	Yes	No	12 months (i.e. at end of intervention)

@ details from Blank et al (2012) (21)

Abbreviations: ft – feet, GP – general practice, hr – hour, mins – minutes, MMSE – Mini-Mental State Examination, RCT – randomised controlled trial, SD – standard deviation, UK – United Kingdom, USA – United States of America, WG – walking group, yrs - years

Supplementary Table 4. Quality assessment

Study	Study design	Selection biases	Performance biases	Attrition biases	Detection biases	Other issues	Overall risk of bias
Avila 1994[@]	RCT	Population representative of the source population. Intervention and comparator well described and appropriate, no allocation concealment	No blinding of investigators, exposure to intervention and comparison adequate, other interventions similar in both groups	Retention rate: 96% intervention; 82% control	Intention to treat (ITT) not reported, estimates of effect size not reported.	Small sample. Quality assessment from NICE Centre for Public Health Excellence Manual report	Medium
Cox 2008	Cluster RCT	Randomisation via computer-generated random numbers in blocks of 8. Stratified and matched for age and BMI. Allocation concealment unclear.	Unclear blinding of control participants. Unclear if controls met.	Retention rate at 6 months: 87% intervention; 76% control; at 12 months: 71% intervention; 69% control. Being older was significantly associated with retention.	ITT used for adherence outcome.	Unclear if intra-class correlation used for reporting of results	Low
Fisher 2004	Cluster RCT	Neighbourhoods randomly assigned by coin toss. Individual participants randomly	No blinding to intervention by investigators. Unclear blinding of	Retention rate 70% intervention group, unclear control group. No significant difference in	Unclear who monitored outcome results or	Unclear if intra-class correlation used for	Low

Study	Study design	Selection biases	Performance biases	Attrition biases	Detection biases	Other issues	Overall risk of bias
		selected from telephone lists.	participants. Probably no socialising in the control group.	socio-demographic characteristics or baseline quality of life.	whether they were blinded.	reporting of results	
Gusi 2008	RCT	Randomised by a random number table. Investigators did not know to which group each patient was referred prior to exercise prescription.	Blinding to intervention not possible. Probably no socialising in the control group.	Retention rate: 86% intervention; 81% control. Participants lost to follow up had a slightly higher probability of being moderately depressed.	Unclear who monitored outcome results or whether they were blinded. ITT reported.	Trial also included a cost-effective-ness analysis	Low
Hamdorf 1999	RCT	Randomised by coin toss. Patients matched by age, height and body mass.	Blinding to intervention not possible. Probably no socialising in the control group.	Retention rate: 75% intervention; 80% control. Reasons for dropping out two in control based on medical advice, three due to family commitments. In intervention two due to medical reasons, 1 due to overseas travel, and 3 due to family commitments.	Unclear who monitored outcome results or whether they were blinded.	Small sample	Medium

Study	Study design	Selection biases	Performance biases	Attrition biases	Detection biases	Other issues	Overall risk of bias
Isaacs 2007	RCT	Block randomisation of variable block sizes (3, 6 or 9). Good allocation concealment.	Unclear description of control group intervention. Blinding to intervention not possible. Probably no socialising in the control group.	Retention rate 60% at 6 months and 50% at 1 year	Outcome assessors not blinded. Participants frequently revealed their assignment to assessors. ITT analysis.	Sample size calculation fully reported.	Medium
Jancey 2008	Cluster RCT	Unit of randomisation was neighbourhood, matched by Socioeconomic Index for Areas#*. Only those with entries in the local telephone directory were included.	Unclear description of control group intervention. Blinding to intervention not possible. Probably no socialising in the control group.	Retention rate: intervention 68%; controls 75%	Unclear if outcome assessment blinded. Unclear ITT.	Unclear if intra-class correlation used for reporting of results	High
Krieger 2009	Cohort	Participants non-randomly selected volunteers, so selection bias likely.	Controls were the housing community residents who completed a survey (n=155 from 1600 housing units)	Retention rate: 91%	Outcomes measured by self-report surveys	-	High

Study	Study design	Selection biases	Performance biases	Attrition biases	Detection biases	Other issues	Overall risk of bias
Kriska 1986 (Pereira 1998)	RCT	Methods of randomisation / allocation concealment not given	High proportion of those randomised to walking did not comply (39%)	Retention rate 100%	ITT reported	Research was still ongoing when paper published	High
Lamb 2002	RCT	Participants randomly selected from GP practices, asked whether they would participate then randomised using remote randomisation service. Enrolling nurse unaware of allocation.	33% of those eligible attended the accompanied walks. Controls met once for advice. Blinding unclear	Retention rate: 73% intervention; 72% control. No significant difference in baseline characteristics between those lost to follow up and those who completed study	Outcomes measured blind to allocation	Sample size calculation given	Medium
Lee 2011	Case-control	Allocation to group by participant preference.	Control intervention was home-based plus monthly group workshops.	Retention rate 55% intervention, 45% control.	Unclear if outcome assessment blinded. Unclear ITT.	-	High
Maki 2012	RCT	Methods of randomisation / allocation concealment not given	Attendance rate during the intervention was 87.5%. Blinding unclear.	Retention rate: 88% intervention; 89% control.	ITT given. Investigators and outcome assessors 'were	-	Medium

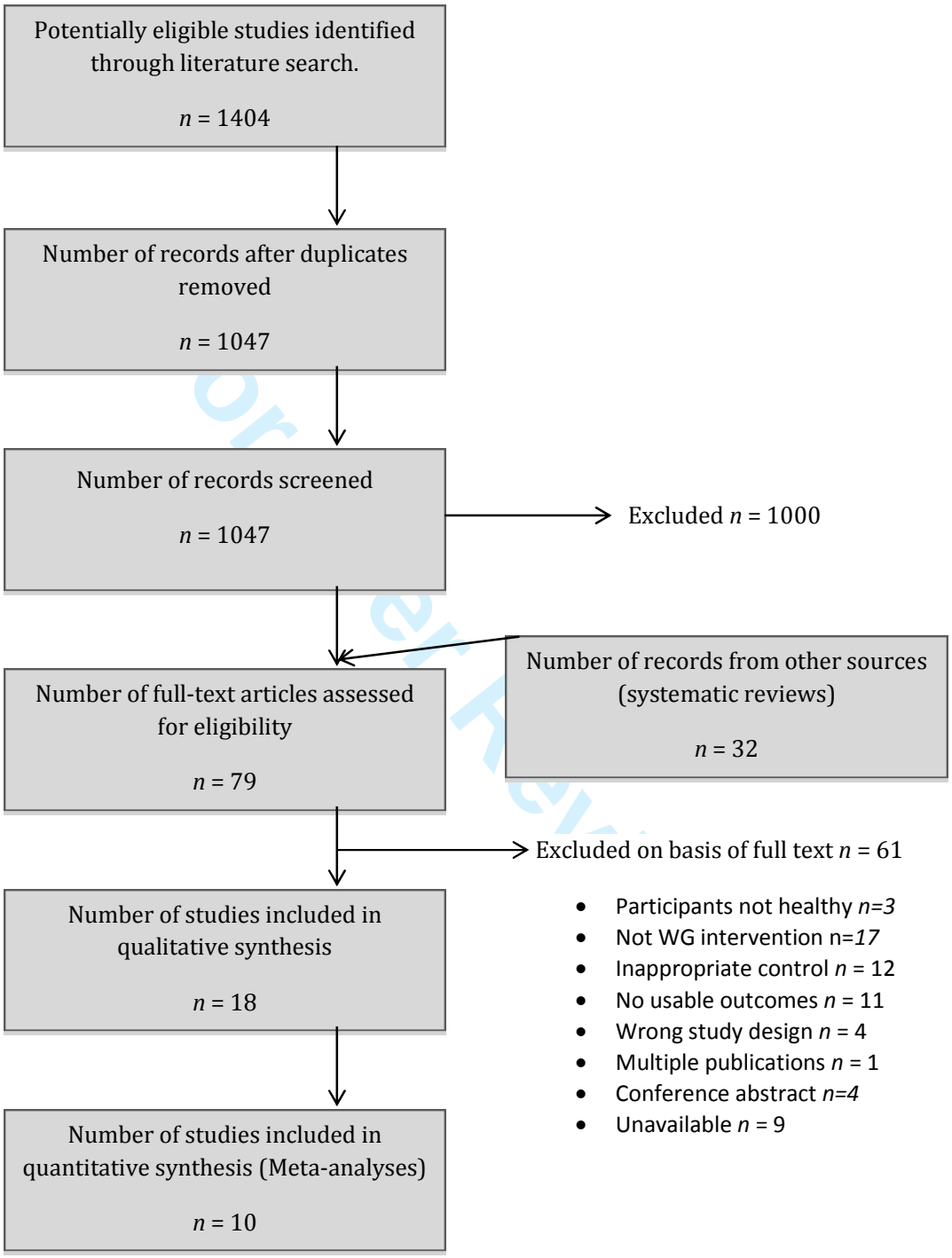
Study	Study design	Selection biases	Performance biases	Attrition biases	Detection biases	Other issues	Overall risk of bias
					separated'		
Moore-Harrison 2008	RCT	Methods of randomisation / allocation concealment not given. Control group participants knew they could join the walking intervention from the start of the trial	Unclear if controls were in groups. Blinding unclear.	Retention rate: 92% (retention by group NR).	Unclear if outcome assessment blinded. Unclear ITT.	Small sample	High
Nguyen 2002	Case Control	Historical control group.	Controls had been in groups before they left the walking project.	Retention rate: NR. States about 60% maintained involvement in the club for at least 6 months.	Unclear if outcome assessment blinded. Unclear ITT.	Some outcome results unclear.	High
Palmer 1995	RCT	Methods of randomisation / allocation concealment not given.	Unclear if control participants ever met when controls. (NB waiting list controls).	Retention rate: 100%	Unclear if outcome assessment blinded. Unclear ITT.	Small sample	High
Resnick 2002	RCT	Randomisation using SPSS package. Participants also randomly chosen from a pool of 120 eligible using	Intervention included multiple complex interventions in addition to walking in	Retention rate: 91% intervention; 78% control. The three individuals were lost due	Unclear if outcome assessment blinded. ITT	Small sample	High

Study	Study design	Selection biases	Performance biases	Attrition biases	Detection biases	Other issues	Overall risk of bias
		SPSS. Unclear if allocation concealment.	groups. Unclear if control participants ever met.	to illness.	not conducted.		
Takahashi 2013	Experi-mental	Unclear whether participants assigned by random allocation or not. Unclear if allocation concealment	Unclear description of control group intervention.	Retention rate: 100%	Unclear if outcome assessment blinded.	Small sample	High
Thomas 2012	Cluster RCT	Computer-generated block randomisation in blocks of 4. Allocation concealment conducted.	Unclear if controls ever met.	Retention rate: 100%	Unclear if outcome assessment blinded. ITT conducted	Intra-class correlation used for reporting of results	Low

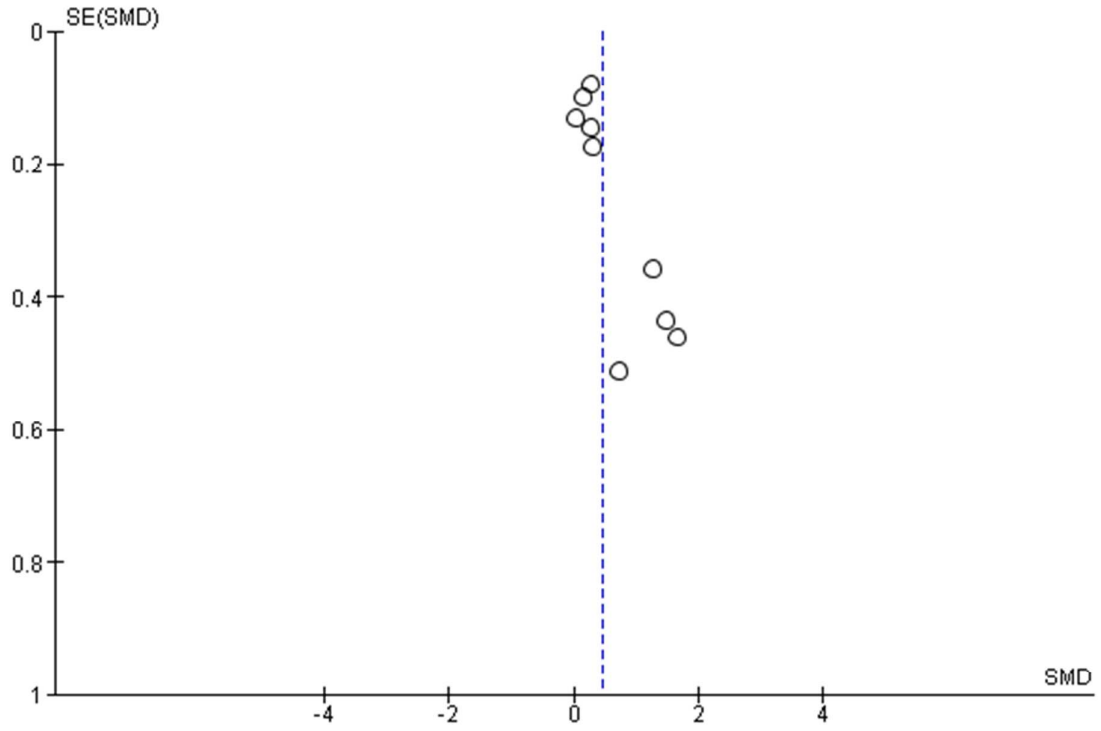
@ details from Blank et al (2012) (21)

SEIFA includes income, educational attainment, employment status and skill level of neighbourhood residents.

Supplementary Figure 1. PRISMA flow diagram



Supplementary Figure 2. Funnel plot



Axis labels - SMD – standardised mean difference, SE (SMD) – standard error of the standardised mean difference.

Supplementary Figure 3. Meta-analysis of proportions physically active in Set 1 (inactive controls)