

Research & Reviews: Journal of Nursing & Health Sciences

The Impact of Physical Activity Interventions on Social Isolation Among Community - Dwelling Older Adults: A Systematic Review

Lauren M Robins^{1,2,3*}, Paul Jansons^{1,2,4}, Terry Haines^{1,2,3}

¹Department of Physiotherapy, Faculty Of Medicine, Nursing And Health Sciences, School Of Primary Health Care, Monash University, Melbourne, Australia

²Allied Health Research Unit, Monash Health, Australia

³Allied Health Research Unit, Kingston Centre, 400 Warrigal Rd Cheltenham, Victoria, Australia

⁴Cranbourne Integrated Care Centre, 140 - 154 Sladen st Cranbourne, Victoria, Australia

Research Article

Received date: 22/01/2016

Accepted date: 15/03/2016

Published date: 22/03/2016

*For Correspondence

Lauren M Robins, Department Of Physiotherapy, Faculty Of Medicine, Nursing And Health Sciences, School Of Primary Health Care, Monash University, Melbourne, Australia

E-mail: lmcro2@student.monash.edu

Keywords: Aged, Humans, Loneliness, Social isolation, Exercise, Physical activity.

ABSTRACT

This paper investigates the effect of physical activity interventions on social isolation in older community - dwelling adults. A mixed methods methodologically inclusive systematic review was conducted for the complete holdings to April 2012, updated to April 2014 of MEDLINE, CINAHL, Embase, Cochrane Central Register of Controlled Trials, PsycInfo and Social Sciences Citation Index. A meta - analysis and narrative synthesis were performed to analyse the data. The pooled estimate of the effect of physical activity interventions on social isolation was 0.41 (95% CI = 0.08 to 0.75). The narrative synthesis outlined that older adults believe group physical activity interventions assist them to meet others, expand their social networks and improve their physical health. Group physical activity interventions had a greater impact on social isolation than social activity alone. Changes in social isolation were not maintained long - term. The findings of this study demonstrate that group physical activity interventions could be used to decrease social isolation in the older community - dwelling population. However, these findings should be viewed with consideration of the inconsistent range of intervention parameters and different measurements for social isolation.

INTRODUCTION

Social isolation is of increasing concern in older adults living in the community due to the ageing population and the increasing morbidity being observed in older adults. Social isolation has a negative impact on health and mortality rates ^[1-3]. Individuals who maintain adequate social relationships have a likelihood of survival twice that of socially isolated older adults. This effect has been highlighted as comparable to the effect of quitting smoking ^[2, 4, 5]. Various definitions for social isolation have been used throughout existing literature, often interchangeably with the term loneliness. Loneliness has been described as the negative emotions felt in response to a lack or loss of companionship or quality relationships, which is a subjective phenomenon ^[6-8]. The concept of social isolation is commonly defined as the more objective counterpart to loneliness, being minimal contact with others ^[6, 8, 9]. However, social isolation has also been described as including one's perception of inadequacy of social activity or quality ^[7, 10, 11]. Therefore, there appears to be some overlap in the concepts of social isolation and loneliness. It is difficult to estimate the proportion of older adults who currently experience social isolation due to variability in the reported measures and definitions of social isolation and lack of existing literature. It was reported that 16% of a cohort of 3,105 Australians surveyed as part of the 2004 annual South Australian Health Omnibus Survey (SAHOS), experienced some degree of perceived social isolation, as measured by the Friendship Scale ^[10]. A summary of studies examining social isolation in the United Kingdom determined that social isolation affected approximately 10% of older adult sample populations with a reported range of 2% to 20% for various

measures of social isolation ^[12]. Although reporting of the prevalence of social isolation in community - dwelling older adults is limited, research has indicated that older people tend to become increasingly more isolated over time ^[13]. Therefore, the per capita prevalence of social isolation in the community is likely to be increasing along with the ageing of the world's population. It is therefore important to identify interventions that may be successful in managing social isolation amongst older adults.

A number of approaches for managing social isolation have been trialed. A recent review examined interventions addressing social isolation ^[14]. This review identified that there was insufficient evidence to support any one intervention, however recommended that participant - driven group - based activities including an element of social support, be used in preference to passive education or training ^[14]. This supports findings of a previous review which also determined that group - based activities combined with a support activity, targeted at specific population groups, such as women, care - givers or the physically inactive were most effective at preventing or managing social isolation ^[15].

An approach that has not specifically been reviewed for its impact on social isolation has been interventions to promote physical activity. An association between physical function and social isolation has been reported in several studies with greater levels of physical activity participation being related to reduced social isolation and lower levels of physical capacity associated with being more socially isolated ^[16-25]. However, it is unclear from these observational studies whether it is the social isolation causing people to be physically inactive, decondition, and lose their physical capacity, or if it is the lower levels of physical capacity that cause people to become socially isolated. It is possible that there may be a vicious cycle relationship where each factor reinforces the presence of the other ^[3, 8]. Previous research has demonstrated that mobility impairments have the ability to limit opportunities for social connection ^[6,26,27]. Other factors associated with mobility limitations such as the perceived social stigma related to physical deficits or depression might lead to social isolation also ^[28]. It is possible that an older adult experiencing social isolation becomes unwilling to leave the house and participate in social or other activities, thereby reducing their opportunity for engagement in physical activity and therefore leading to decreased physical capacity. It is further possible the relationship between social isolation and physical function may be confounded by factors concurrently influencing social isolation and physical function.

Randomised trials are often seen as a standard for establishing causal relationships. It is difficult to conduct a randomised controlled trial of social isolation or physical capacity; it is, however, possible to look at the effect of interventions designed to affect one or the other on both outcomes. The effect of social interventions on social isolation has previously been reviewed though there appears to be an absence of evidence from these trials examining whether physical capacity or participation were changed ^[14,29]. It is also possible that physical activity interventions may be able to both increase physical function and mitigate social isolation. It is not currently known if physical activity interventions decrease social isolation. This review aims to synthesize available evidence to determine whether physical activity interventions have an impact on social isolation.

METHOD

A mixed methods systematic review, including meta - analysis and narrative synthesis, was conducted of existing literature. A methodologically inclusive design was adopted, not limited to randomised controlled trials, due to the relative lack of randomised trials examining physical activity interventions to address social isolation.

Search Strategy

The search for relevant literature was originally conducted of the complete holdings, to April 2012, with an update in April 2014 to identify all studies that investigated the effect of a physical activity intervention on social isolation in older, community - dwelling adults. The databases, search terms and search strategy used are outlined in Tables 1 and 2. A manual search of reference lists of appropriate systematic reviews and included papers was also conducted ^[14,15]. The complete list of articles found in each database was exported into an Endnote file to be assessed for inclusion and exclusion based on the title and abstract. Two independent reviewers sorted the search yield to identify potentially eligible studies by scanning the title and abstract. Discrepancies were discussed between the two researchers and when a consensus agreement could not be reached the full article was sourced and determined whether it met inclusion criteria by a third researcher. All potentially eligible studies were then sourced in full and sorted for inclusion and exclusion using the criteria described to follow.

Table 1. Search strategy.

	Intervention	Outcome	Exclude
Older\$.ti,ab	(Physical\$ ADJ activit\$.ti,ab	Social isolation/	Mouse
Elder\$.ti,ab	(physical\$ ADJ function\$.ti,ab	(social\$ ADJ isolat\$.ti,ab	Mice
Aged.ti,ab	(physical\$ ADJ capacit\$.ti,ab	(social\$ ADJ participat\$.ti,ab	Rat\$
(old ADJ age).ti,ab	(physical\$ ADJ participat\$.ti,ab	(isolated ADJ (elder\$ or old\$)).ti,ab	Adolescent\$
(ageing or aging).ti,ab	Mobility.ti,ab	(social\$ ADJ alienat\$.ti,ab	Youth

Senior\$.ti,ab	(physical\$ ADJ capabilit\$.ti,ab	(social\$ ADJ exclu\$.ti,ab	Child\$
Geriatric.ti,ab	(physical\$ ADJ abilit\$.ti,ab	(social\$ ADJ environment).ti,ab	
Retire\$.ti,ab	Exercis\$.ti,ab	Lonel\$.ti,ab	
	(group ADJ exercise).ti,ab	Isolat\$.ti,ab	
	Gym.ti,ab	(community ADJ participation).ti,ab	
	(fitness ADJ class\$.ti,ab	(community ADJ activit\$.ti,ab	
	(Strength\$ ADJ (exercise\$ or activit\$)).ti,ab		
	(Endurance ADJ (exercise\$ or activit\$)).ti,ab		
	Walk\$.ti,ab		
	Physiotherap\$.ti,ab		
	(physical ADJ intervention\$.ti,ab		
	(physical ADJ therap\$.ti,ab		
	(Aerobic\$ ADJ exercise\$.ti,ab		
	Yoga.ti,ab		
	Tai chi.ti,ab		
	Hydrotherapy.ti,ab		

ti = title, ab = abstract, ADJ = adjacent. Words within columns combined using 'OR'. "Person", "Intervention" and "Outcome" columns were combined using 'AND'. The "Exclude" column was combined using 'NOT' in order to narrow the search yield.

Table 2. Database search yields.

Database	2012 Yield	2012 - 2014 Yield
Ovid MEDLINE (1946 onwards)	424	74
Embase (1974 onwards)	53	21
CINAHL (1937 onwards)	423	96
Cochrane Central Register of Controlled Trials (1991 onwards)	34	3
PsycINFO (1806 onwards)	224	46
Social Sciences Citation Index (1900 onwards)	152	37
Total	1310	277
Duplicates	283	57
Total with duplicates deleted	1027	220

Study selection

The study eligibility criteria for this systematic review were determined a priori. Inclusion and exclusion criteria were derived to maximize the literature considered for inclusion in this review, the details for each criterion follow. **Population - Older adults.** Studies were included if the author of the study defined the target population as comprised of older adults. This allows for inconsistency in the definition of a minimum age to classify 'older adults' within the literature [15].

Population - Community dwelling. Studies were considered for inclusion if they assessed older adults living within the community. Social isolation in older adults living in residential aged care facilities is considered a separate issue to that of social isolation in community - dwelling older adults [8].

Study design. A methodologically inclusive review was conducted of existing literature due to the relative lack of randomised trials examining physical activity interventions to address social isolation [14,15]. Articles were considered for inclusion if an intervention was employed and follow - up measures for social isolation reported. The study designs included randomised controlled trials, non - randomised controlled trials and quasi - experimental designs (prospective randomised longitudinal designs and pre - /post - test designs). Studies reporting qualitative survey results for a physical activity intervention were also included to further explore for any impact of such interventions on social isolation. Studies were not limited to a year of publication to broaden the search yield.

Intervention type. Intervention studies were considered for inclusion for any type of physical activity intervention. The WHO defines physical activity as any bodily movement produced by muscles that requires energy expenditure [30]. This includes exercise as well as other bodily movement performed as part of work, play, active transportation, household chores and recreational activities. All types of physical activity interventions were included in this review. If a study included a control group, the control activity could be either no intervention or alternative treatment.

Outcome measures – Social isolation. For the purposes of this review, both social isolation and loneliness were considered using the various author definitions. Studies were considered for inclusion if they reported a measure of social isolation or loneliness as either primary or secondary outcome. Measures of size, frequency and diversity of social contact along with subjective measures of perception of social isolation or loneliness were included. Measures as defined by the included article's author, were included as, historically 'social isolation' has been interchangeable with 'loneliness', and the two terms have been inadequately defined throughout the literature [14]. Qualitative survey results for studies applying a physical activity intervention were considered for inclusion in this review if isolation or loneliness were discussed.

Exclusion criteria. Studies were excluded if they examined non - human subjects, applied a case - study design or if the article was not published in English.

Data extraction

Data was extracted from included studies by the principal researcher (___). The information extracted included: the year of publication, study design, participant number, average age of participants, gender, participant health status (including targeted medical conditions), study setting (metropolitan or rural), the intervention and control activities examined and social isolation measure. Statistical data reporting the effect of physical activity interventions on social isolation were extracted including the mean (SD), p - values or percentages.

Data analysis

A meta - analysis was conducted of the included studies for which statistical data could be pooled using a random effects analysis in Stata11 [31]. All studies were considered alongside the meta - analysis using a critical narrative approach. The meta - analysis for intervention studies was conducted using the number of participants, post - intervention mean (SD) data for the intervention and control groups. A forest plot was constructed using the standardised mean difference effect size (Cohen method). For the overall pooled results, heterogeneity was reported using Cochran's Q and inconsistency, I².

The risk of bias was examined by applying existing checklists to included trials. Specifically, randomised controlled trials were evaluated using the PEDro scale, quasi - experimental designs were evaluated using the Newcastle - Ottawa Quality Assessment Scale (NOS) for Cohort Studies and qualitative studies were evaluated using the CASP [32-34]. Bias was considered for each individual study and where necessary, was included in the narrative synthesis.

RESULTS

Selected studies

The flow of studies through this review is illustrated in Figure 1. The number of papers located within each database for the original search and updated search are presented in Table 2. Additional articles were located through scanning reference lists and a small number of relevant articles were previously known to the author. A previous systematic review investigating various interventions targeting social isolation was also located, however yielded no further relevant studies [14]. The details of included studies are summarized in Table 3, including an assessment for risk of bias.

Table 3. Study details.

Reference	Study design	n	Intervention	Control	Social isolation measure	RA
[41]	Pre - /post - design	6	Group: Gardening at community garden for 8 weeks	None	Dartmouth COOP Functional Health Assessment Charts (Social Support, Social Activities and quality of life)	02 - Sep
[40]	Pre - /post - design within subjects	225	Group: Community - based strength training and education program 1x/week for 10 weeks	None	SF - 36: social functioning	02 - Sep
[39]	RCT	62	Group: Water exercises with strength training 5x/week for 5 months	Group: Water exercises with calisthenics exercises 5x/week for 5 months	The Older Americans Resources and Services Multidimensional Functional Assessment Questionnaire Scale	03 - Oct
[47]	RCT	50	Group: Water - based exercise and self - management program for 60mins, 2x/week for 10 weeks	No particular instructions	SF - 36: social functioning	07 - Oct
[48]	RCT	70	Group: walking, hydrogymnastics, strengthening and stretching exercise for 50mins 2x/week for 12 weeks	No physical activity, sedentary	WHOQOL - Old questionnaire: social participation measure	04 - Oct
[35]	RCT	50	Group: Exercise and education of unknown duration	Not particular instructions	RAND - 36: social functioning	06 - Oct
[36]	Pre - /post -	234	Group: Exercise and education of unknown duration	No particular instructions	Loneliness: "I feel lonely" rated 1 - 5, 5 = not lonely at all	04 - Sep
[42]	RCT	544	Group: Exercise program (flexibility, aerobic and resistance) for 60mins, 3x/week for 10 months	Group: Could enrol in any program except multi - component program used for intervention for 10 months	SF - 36: social functioning	04 - Oct
[43]	RCT	36	Playing Wii with a research assistant for 60mins, 1x/week for 10 weeks	Watched TV with a research assistant or "no visit" control for 60mins, 1x/week for 10 weeks	UCLA Loneliness Scale, version 3	05 - Oct

[38]	RCT	99	Group: physical activity (sitting, standing, walking, balance and mobility indoors) for 30 - 60mins, 1x/week for 9 months and a lifestyle course for 2hours, 1x/week for 9 months	Group: physical activity (sitting, standing, walking, balance and mobility indoors) for 30 - 60mins, 1x/week for 9 months	SF - 36: social functioning	07 - Oct
[37]	RCT	174	Group: Walking for 10 - 15mins and progressing to 40mins, 3x/week for 6 months	Group: Stretching and toning program for 40mins, 3x/week for 6 months	UCLA Loneliness Scale and the Social Provisions Scale (SPS)	04 - Oct
[44]	Non - randomised controlled trial	245	Individual: Home - based stretching, strength, walking performed as often as possible and a support program for 5 years	No activity	Frequency of doing a hobby, associating with others, participating in a senior club activity, and volunteering	01 - Sep
[46]	RCT	30	Group: Water exercise either 1x/week or 2x/week for 6 months	Group: Spent time at lunch, bathing, watching TV, socialising and recreation for 6 months	SF - 36, Social Functioning	06 - Oct
[45]	Prospective randomised longitudinal study	22	Group: Water exercise 2x/week for 2 years	Group: Water exercise 1x/week for 2 years	SF - 36, Social Functioning	05 - Oct
[50]	Qualitative interview	28	Already participating in group physical activity	None	Qualitative interview	9/10 [†]
[51]	Qualitative interview	13	Group: Already participating in group physical activity	None	Qualitative interview	7/10 [†]
[49]	Mixed methods: qualitative outcomes for social isolation	42	Group: gym - based exercise program 2x/week for 12 weeks	Comparison group	Qualitative interview	7/10 [†]

N = number of participants, RA = Risk of bias Assessment, na = not appropriate, NHP = Nottingham Health Profile.

Note: A score out of 10 indicates PEDro scale was used to assess risk of bias except for scores marked with † which used the CASP. A score out of 9 indicates the NOS was used for the risk of bias assessment. Rows highlighted in grey indicate qualitative survey design was used.

*One included article had two studies described within, both were included in this review.

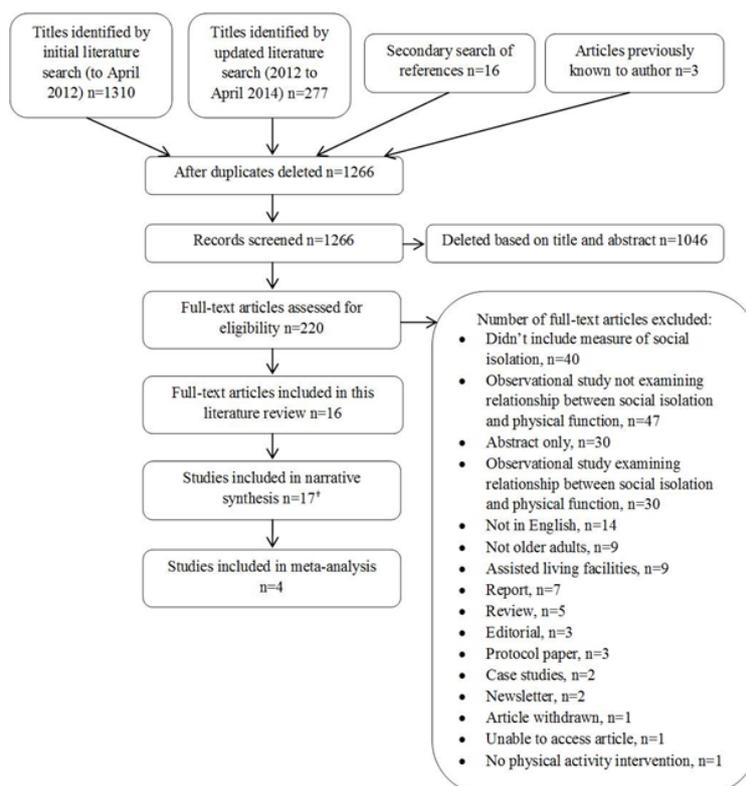


Figure 1. The flow of papers.

Data was extracted for 17 studies out of a total 16 included articles. In one paper, two studies were described, one was a randomised controlled trial the other a pre /post - intervention study [35,36]. The included studies were categorised as either 'intervention' studies where the effect of a physical activity intervention on social isolation was examined (n = 14), or qualitative studies which applied qualitative interview outcome measures (n = 3). Only 4 studies provided sufficient data to be pooled in a meta - analysis. Reasons for the remaining intervention studies being excluded from the meta - analysis include: two physical activity interventions were compared (no control group) (n = 3), one intervention group and no control (n = 1), no results were reported for control (n = 1) only a p - value reported (n = 1), a regression analysis performed and no mean (SD) data reported (n = 1), no follow - up mean (SD) data reported (n = 1), results reported as percentages (n = 1) and reported long - term follow - up data for a study already included in the meta - analysis (n = 1) [36-45]. Authors were contacted via email to request baseline and follow - up data, including number of participants and mean (SD), however, no further data was obtained.

Social isolation was measured in a variety of ways within the included trials. The most commonly used measurement was the SF - 36 or RAND - 36 social functioning score (n = 7) all other measures were used by two or fewer studies. A few papers reported qualitative interview outcome data for social isolation (n = 3) (grey highlighted rows in Table 3).

The majority of physical activity interventions were group - based (n = 16) with a number conducted in water (n = 4) (Table 3). A limited number of trials did not include a comparison group (n = 5). The intervention groups were compared to a no - intervention control (n = 7), a physically active group intervention (n = 5) or other social activities (n = 2).

Meta - analysis

A meta - analysis was conducted for a small number of intervention studies (n = 4). One trial included in the meta - analysis reported outcomes for two intervention groups (once weekly intervention and twice weekly) compared to a control, at two time points (12 weeks and 24 weeks) [46]. Both intervention groups were included and treated as separate studies. To ensure control group participants were not counted twice the control group number was divided in half and the mean (SD) values for the outcomes retained. Data reported at 24 weeks was used in the meta - analyses as this was reported at the end of the intervention, consistent with other reported measures pooled within the meta - analysis. The data used to conduct the meta - analysis is presented in Figure 2. The pooled estimate of the effect of physical activity interventions on social isolation was 0.41 (95% CI = 0.08 to 0.75), Cochran's Q = 4.88 and I² = 18% (Figure 2). The results of this meta - analysis suggest that physical activity interventions have a significant impact on social isolation.

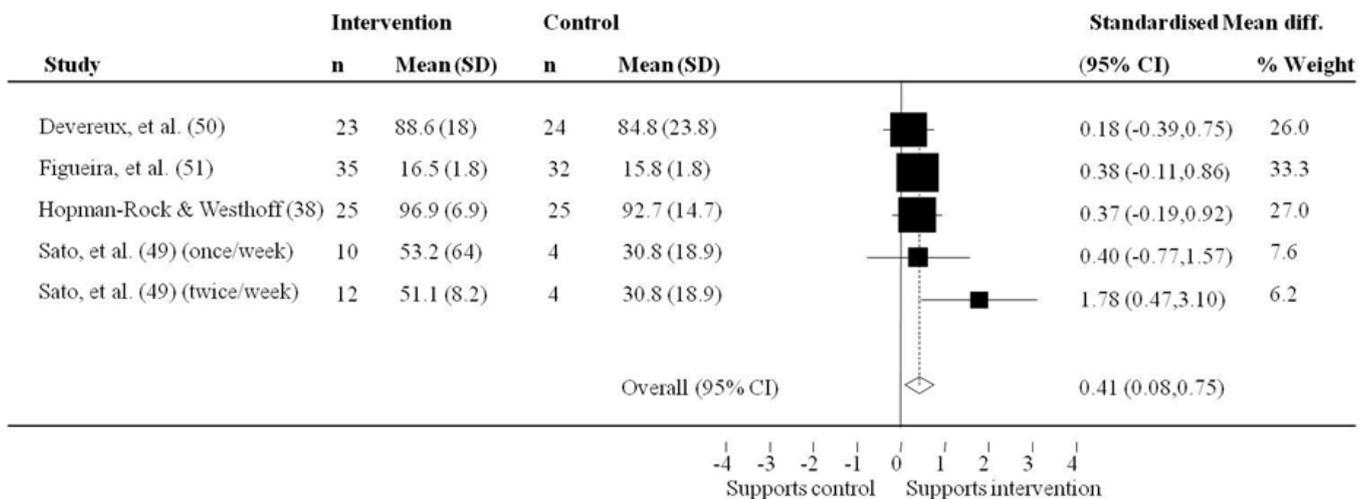


Figure 2. Meta - analysis for the effect of physical activity intervention on social isolation.

Narrative synthesis

A narrative synthesis was conducted for all studies included in this review (n = 17). This was performed to maintain studies that were unable to be pooled in the meta - analysis. The intervention studies (n = 14) were synthesized separately to the qualitative studies (n = 3). Qualitative studies were synthesized to explore older adults' perspectives of the impact of physical activity interventions on social elements.

Intervention studies. There appeared to be variation in the impact of the physical activity interventions investigated on the outcome of social isolation. The majority of studies reported a decrease in social isolation (n = 10), while a few reported no significant effect of physical activity interventions on social isolation (n = 4) [35-44]. The studies reporting a positive impact on social isolation were entirely group - based interventions, with the exception of one study which comprised 6 group - based education and exercise sessions, and following this, participants were encouraged to perform an independent home exercise program at least three times per week [36]. The studies reporting no significant impact on social isolation included one study with no group - based component, another with 6 group - based sessions, one with no control group, while the control group for the fourth study

was able to engage in any physical activity programs offered by the centre which may have negated any group - based benefit from the intervention in that study ^[35,40,42,44].

It appears that a physical activity intervention combined with social interaction may have a greater impact on social isolation than social activity alone. Kahlbaugh et al. reported on a three - group randomized trial where a no - intervention control was compared to a Wii bowling intervention with a research assistant, and watching television with a research assistant. The participants performing the Wii program had significantly lower loneliness scores post - intervention, whereas, the participants watching television were significantly more lonely and the no - intervention control also became increasingly lonely ^[43]. Sato et al. investigated the effect of two group - based physical activity interventions compared with a social interaction control and found physical activity interventions led to participants reporting significantly less social isolation compared to the social interaction control group at 6 months ^[46]. Lund et al. compared a physical activity intervention combined with a lifestyle course involving peer exchange, self - reflection, discussion, lectures and outings to a physical activity intervention alone ^[38]. While both interventions led to an improvement in social functioning, the difference between the two groups at follow - up was not significant indicating that both interventions were equally effective at reducing social isolation. It seems changes in social isolation with physical activity interventions are not maintained over the long - term. McAuley et al. found improvement in social isolation at the completion of a 6 month physical activity intervention was not sustained at 12 month follow - up ^[37]. Of particular concern, social isolation had significantly increased at 12 months relative to 6 months within the intervention group. Sato et al. similarly found that improvements in social isolation were not maintained between 12 and 24 month follow - ups for both a once weekly 24 - month water exercise intervention and a twice weekly water exercise intervention ^[45]. This finding was slightly different to McAuley et al. as the group exercise intervention had continued for the entirety of the follow - up period in the study by Sato et al ^[37,45]. Oida et al. found no difference in social isolation between a physical activity intervention and control following a 5 year intervention ^[44].

Qualitative studies. The qualitative studies in this review outlined themes supporting the meta - analysis and intervention studies. These studies found participants believed that taking part in group physical activity interventions helped them meet others and expand their social networks, thereby avoiding social isolation ^[47-51]. One study quoted a participant who said “It’s about the camaraderie. The group is around for each other.” ^[49]. The qualitative studies suggest the importance of physical activity interventions for not only providing a means to meet new people, but also to maintain a functional level necessary to leave the house to access and engage in social situations. Wallace, et al. reports that participants in a comparison group who did not perform a physical activity intervention believed that deteriorating health limited participant’s physical activity and led to social isolation ^[49]. However, Stathi, et al. found many participants reported physical activity interventions did not provide enough opportunity for socializing ^[51]. One participant was quoted to say “You are literally in the class, but then everybody is gone. They are all busy”. A recommendation was made for future physical activity programs to increase opportunities for social interaction within and beyond the class ^[51].

Risk of bias

Potential sources of bias for the randomized controlled trials included participants and therapists not being blinded to group allocation. This is often the case for physical activity interventions when being compared to a no - intervention control. Also the lack of an intention to treat analysis was common in included papers. Contributing to bias in the qualitative studies was lack of consideration for a relationship between the researcher and participants.

DISCUSSION

The results of this review suggest that group physical activity interventions are associated with decreases in social isolation among community - dwelling older adults. Qualitative studies reported older adults believed group physical activity interventions assisted them in meeting others, expand their social networks and helped to maintain or improve their physical health allowing them to participate in the community socially, thereby avoiding social isolation. Various physical activity interventions were reviewed, with the majority being group - based and a number being performed in water. The findings suggest that physical activity interventions combined with social interaction may have a greater impact on social isolation than social activity alone. However, changes in social isolation were not maintained over the longer term.

A small number of studies in this review compared social activities alone to group physical activity interventions and results indicate that the effect of group physical activity interventions may not be entirely mediated via the social contact element of those activities. One of these social activities involved watching television with a research assistant, another was designed to provide social interaction; participants spent time at lunch, bathing, watching television, communicating and in recreation ^[43,46]. In both cases, the participants in the physical activity intervention became less socially isolated than those who only engaged in social activities. This finding suggests that it may be possible for physical activities that do not have a social element to also reduce social isolation. Lund, et al. compared a group physical activity intervention with lifestyle course to a group physical activity intervention alone and found there was not a significant difference between the two groups on social isolation at the end of the intervention ^[38]. The details of exactly what was provided during the lifestyle course are not provided other than to state the “programme was occupation - based and person - centred” and “themes were addressed through peer exchange, self - reflections, discussions, lectures and outings” ^[38]. The lifestyle course was, however, conducted in a group environment and presented the opportunity for

additional social interaction. This suggests that the key element to the success of a group physical activity intervention is perhaps the physical activity component itself and any additional social interaction may not prove to be of further benefit to decreasing social isolation in older adults.

Previous reviews of the various methods used to address social isolation have not employed meta-analysis techniques^[14,15]. As such, the results of the meta-analysis generated in this review are unable to be compared to previous reviews. These reviews found activities targeting specific population groups that included social activity or support conducted in a group environment, where older adults are active participants; appear to be effective for reducing social isolation. The meta-analysis findings suggest that physical activity interventions significantly improve social isolation in older community-dwelling adults. The studies analyzed in the meta-analysis were conducted in Australia, the Netherlands, Japan and Brazil. The limited number of papers included in the meta-analysis and hence, small range of countries considered, impacts on the transferability of results to other countries, particularly those with lower socio-economical status.

Papers were excluded from analysis in this review if not published in English as it was considered too costly to translate articles. This language bias may have contributed to a diminished number of papers appropriate for inclusion in the meta-analysis. There was potential bias created from performing a meta-analysis on a relatively small number of trials. Several other areas of concern were identified by our assessment of risk of bias within our included articles. Several studies used non-random sampling techniques, instead using convenience sampling of populations that may have been easier to recruit (e.g., senior centre volunteers). The issue with these sampling approaches is that people with severe social isolation may not contact these services and thus be under-represented in the studies. The inability to blind participants and therapists to group allocation for physical activity interventions may have led to an obsequiousness bias in responses favouring the intervention on the self-reported outcome of social isolation. Another feature of this field of research is the inconsistency of a measurement scale for the construct of social isolation. Some measures focus on the frequency of contact with others, others have focused on the number of people the participant has contact with and the remainder considers the emotions associated with social isolation or feelings of loneliness. Despite this variability, the nature of the findings was quite consistent across the different studies, indicating that this may not be a major limitation.

Further research is required to better understand the effect of physical activity interventions on decreasing and preventing social isolation in older community-dwelling adults. The results of this review suggest that participation in group-based physical activity programs is effective in addressing social isolation, but it is uncertain as to the mechanisms for this effect. Before prescribing physical activity interventions to address social isolation, health professionals need to consider the individual's environment, such as with whom they live with, their current health status, economic situation and previous experience with group physical activity interventions. These factors will serve to impact the likely success of such an intervention. Future observational and experimental studies may be able to differentiate the effect that social interaction in a group exercise environment has on social isolation from the effect that the physical benefits of participating in a physical activity program have on social isolation. This would be important to develop the most effective and cost-effective approaches to address social isolation, while possibly addressing other aspects of physical health and well-being.

REFERENCES

1. Seeman TE. Health promoting effects of friends and family on health outcomes in older adults. *American Journal of Health Promotion*. 2000;14:362-370.
2. House JS, et al. Social relationships and health. *Science*. 1988;241:540-545.
3. Hawton A, et al. The impact of social isolation on the health status and health-related quality of life of older people. *Quality of Life Research*. 2011;20:57-67.
4. House JS. Social isolation kills, but how and why? *Psychosomatic Medicine*. 2011;63:273-274.
5. Holt-Lunstad, et al. Social relationships and mortality risk: a meta-analytic review. *PLoS Medicine*. 2010; 7.
6. Kopec JA. Concepts of disability: the activity space model. *Social Science & Medicine*. 1995;40: 649-656.
7. Wenger GC, et al. Social isolation and loneliness in old age: review and model refinement. *Ageing and Society*. 1996;16: 333-358.
8. Grenade L, et al. Social isolation and loneliness among older people: issues and future challenges in community and residential settings. *Australian Health Review*. 2008;32:468-478.
9. Wenger GC and Burholt V. Changes in levels of social isolation and loneliness among older people in a rural area: a twenty-year longitudinal study. *Canadian Journal on Aging*. 2004;23:115-127.
10. Hawthorne G. Perceived social isolation in a community sample: its prevalence and correlates with aspects of peoples' lives. *Social Psychiatry and Psychiatric Epidemiology*. 2008;43:140-150.
11. Greaves M and Rogers-Clark C. The experience of socially isolated older people in accessing and navigating the health care system. *Australian Journal of Advanced Nursing*. 2009;27: 5-11.

12. Victor C, et al. Being alone in later life: loneliness, social isolation and living alone. *Reviews in Clinical Gerontology*. 2000;10:407-417.
13. Dykstra PA, et al. Changes in Older Adult Loneliness: Results From a Seven-Year Longitudinal Study. *Research on Aging*. 2005;27:725-747.
14. Dickens AP, et al. Interventions targeting social isolation in older people: a systematic review. *BMC Public Health*. 2011;11:1-22.
15. Cattan M, et al. Preventing social isolation and loneliness among older people: a systematic review of health promotion interventions. *Ageing & Society*. 2005;25:41-67.
16. Balboa-Castillo T, et al. Longitudinal association of physical activity and sedentary behavior during leisure time with health-related quality of life in community-dwelling older adults. *Health and Quality of Life Outcomes*. 2011;9:1-10.
17. Thraen-Borowski KM, et al. Dose-response relationships between physical activity, social participation, and health-related quality of life in colorectal cancer survivors. *Journal of Cancer Survivorship*. 2013;7:369-378.
18. Guedes DP, et al. Quality of life and physical activity in a sample of Brazilian older adults. *Journal of Aging and Health*. 2012;24: 212-226.
19. Mazo GZ, et al. Association between participation in community groups and being more physically active among older adults from Florianopolis, Brazil. *Clinics*. 2011;66:1861-1866.
20. Valadares ALR, et al. Association between different types of physical activities and quality of life in women aged 60 years or over[Evaluation Studies]. *Revista Da Associacao Medica Brasileira*. 2011;57: 450-455.
21. Cacioppo JT, et al. Perceived social isolation makes me sad: 5-year cross-lagged analyses of loneliness and depressive symptomatology in the Chicago Health, Aging, and Social Relations Study. *Psychology & Aging*. 2010;25:453-463.
22. Chan A, et al. Correlates of limitations in activities of daily living and mobility among community-dwelling older Singaporeans. *Ageing & Society*. 2011;31:663-682.
23. Cohen-Mansfield J, et al. Loneliness in older persons: a theoretical model and empirical findings. *International Psychogeriatrics*. 2007;19: 279-294.
24. Mullins LC, et al. Social determinants of loneliness among older americans. *Genetic, Social, and General Psychology Monographs*. 1996;122:453-473.
25. Ozturk A, et al. The relationship between physical, functional capacity and quality of life (QoL) among elderly people with a chronic disease. *Archives of Gerontology and Geriatrics*. 2011;53:278-283.
26. Hirvensalo M, et al. Underlying factors in the association between depressed mood and mobility limitation in older people. *Gerontology*. 2007;53:173-178.
27. Steptoe A, et al. Social isolation, loneliness, and all-cause mortality in older men and women. *Proceedings of the National Academy of Sciences*. 2003;110:5797-5801.
28. Gordon NF, et al. Physical activity and exercise recommendations for stroke survivors: an American Heart Association scientific statement from the Council on Clinical Cardiology, Subcommittee on Exercise, Cardiac Rehabilitation, and Prevention; the Council on Cardiovascular Nursing; the Council on Nutrition, Physical Activity, and Metabolism; and the Stroke Council. *Journal of the American Heart Association*. 2004;35:1230-1240.
29. White SM, et al. Physical activity and quality of life in community dwelling older adults. *Health and Quality of Life Outcomes*. 2009;7.
30. World Health Organisation. *Global strategy on diet, physical activity and health*, 2014.
31. StataCorp. *Stata Statistical Software: Release 11* College Station, TX: StataCorp LP, 2009.
32. Centre for Evidence-Based Physiotherapy PEDro: *Physiotherapy Evidence Database*, 2013.
33. Wells GA, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. *3rd Symposium on Systematic Reviews: Beyond the Basics*, 2000.
34. Public Health Resource Unit NHS England. *Critical Appraisal Skills Program (CASP) Qualitative research: appraisal tool*, 2006.
35. Hopman-Rock M, et al. Health education and exercise stimulation for older people: development and evaluation of the program "Healthy and Vital". *Tijdschrift voor Gerontologie en Geriatrie*. 2002a;33:56-63.
36. Hopman-Rock M, et al. Health education and exercise stimulation for older people: development and evaluation of the program "Health and Vital". *Tijdschrift voor Gerontologie en Geriatrie*. 2002b;33:56-63.
37. McAuley E, et al. Social relations, physical activity, and well-being in older adults. *Preventive Medicine*. 2000;31,608-617.
38. Lund A, et al. A lifestyle intervention as supplement to a physical activity programme in rehabilitation after stroke: a randomized controlled trial. *Clinical Rehabilitation*. 2012;26:502-512.
39. Cancela Carral JM and Ayan Perez C. Effects of high-intensity combined training on women over 65. *Gerontology*. 2007;53:340-346.

40. Bates A, et al. Staying active, staying strong: pilot evaluation of a once-weekly, community-based strength training program for older adults. *Health Promotion Journal of Australia*. 2009;20:42-47.
41. Austin EN, et al. Community gardening in a senior center: a therapeutic intervention to improve the health of older adults. *Therapeutic Recreation Journal*. 2006;40:48-57.
42. Hughes SL, et al. Best-practice physical activity programs for older adults: findings from the National Impact Study. *American Journal of Public Health*. 2009;99:362-368.
43. Kahlbaugh PE, et al. Effects of playing Wii on well-being in the elderly: physical activity, loneliness, and mood. *Activities, Adaptation & Aging*. 2011;35:331-344.
44. Oida Y, et al. Effects of a 5-year exercise-centred health-promoting programme on mortality and ADL impairment in the elderly. *Age and Ageing*. 2003;32:585-592.
45. Sato D, et al. Comparison of 2-year effects of once and twice weekly water exercise on activities of daily living ability of community dwelling frail elderly. *Archives of Gerontology and Geriatrics*. 2009;49:123-128.
46. Sato D, et al. The water exercise improves health-related quality of life of frail elderly people at day service facility. *Quality of Life Research*. 2007;16:1577-1585.
47. Devereux K, et al. Effects of a water-based program on women 65 years and over: A randomised controlled trial. *Australian Journal of Physiotherapy*. 2005;51:102-108.
48. Figueira HA, et al. Effects of a physical activity governmental health programme on the quality of life of elderly people. *Scandinavian Journal of Public Health*. 2012;40:418-422.
49. Wallace R, et al. Effects of a 12-week community exercise programme on older people. *Nursing Older People*. 2014;26:20-26.
50. Stathi A, et al. Physical activity and dimensions of subjective well-being in older adults. *Journal of Aging and Physical Activity*. 2002;10:76-92.
51. Stathi A, et al. The experiences of older people participating in exercise referral schemes. *Journal of the Royal Society for the Promotion of Health*. 2004;124:18-23.