The effect of the ENJOY Seniors Exercise Park physical activity program on falls in older people in the community: a prospective pre-post study design

Running head: The effect of the ENJOY program on falls in older people

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Declaration

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Abstract

Background: The ENJOY project (Exercise interveNtion outdoor proJect in the cOmmunitY for older people) is a community-based research project actively promoting physical activity engagement through the delivery of an exercise program using outdoor multimodal exercise equipment. This study investigated the impact of the physical activity program on falls in older people.

Method: This study was a multi-site prospective study with a pre-post intervention design and 12-month follow up. Eighty older people with increased falls risk underwent a 12-week supervised outdoors exercise program followed by a 6-month maintenance phase. The proportion of fallers and falls incidence were compared between the preceding and the prospective years.

Results: A sample of 54 (age 72.4±7.3, 79.6% women) was available for the 12 months analysis (due to COVID19 lockdowns, data of 19 participants were excluded and 4 dropped out). Number of fallers (from 51.8% to 31.4%, $p=0.03$) and falls incidence (from 42 to 29 falls, $p<0.01$) were significantly reduced at the 12-months follow up.

Conclusion: The ENJOY Seniors Exercise Park program integrates outdoor multimodal exercise stations including specific exercises designed to challenge dynamic balance during functional daily movements. The outcomes provide preliminary evidence for the potential positive impact of the ENJOY Seniors Exercise Park in reducing falls for older people.

Key words: falls, older people, Seniors Exercise Park, physical activity

INTRODUCTION

Falls are the leading cause of unintentional injury in older people, with approximately one in three older Australians aged 65 and over experiencing one or more falls within a 12 months period [1]. With population ageing, the likelihood of falls, associated injuries and hospitalisation are also predicted to increase[1,2]. The adverse consequences of falls include decreased function, quality of life and increased mortality [3].

Physical activity is recommended as an effective intervention to reduce the rate of falls and risk of falling in community-dwelling older adults [4], with exercises that focus on balance, function and strength likely to reduce the risk by 34%. Global physical activity guidelines recommend older people to engage in at least 150 minutes of moderate physical activity per week[5]. However despite the strong evidence regarding beneficial effects of exercise on older people's health and falls reduction, many older people do not engage in sufficient physical activity [6], and falls remain highly prevalent. Various factors contribute to lack of participation in physical activity including lack of effective scalable interventions [7], poor adherence to physical activity [8] and poor adherence to falls prevention programs [9]. In addition, factors impacting translation of physical activity programs into practice are also important contributory factors. These include lack of evidence of transferability of trial results to the community setting, insufficient local expertise to roll out community exercise programs, and inadequate infrastructure to integrate evidence-based programs into community practice [10].

To address some of the above limitations, we have been undertaking research involving the built environment, utilising specialised outdoor exercise equipment, and physical activity intervention in a community setting. Outdoor exercise equipment has become quite common in recent years, [11-13] but these are rarely designed to meet the needs of older people [14]. The inclusion of accessible outdoor environments with suitable age-specific specialised exercise equipment motivated our body of work due to its potential to promote physical activity and social connectedness for this demographic. The ENJOY project (Exercise interveNtion outdoor proJect in the cOmmunitY for older people) was a

research project (2018-2020) actively promoting physical activity engagement and well-being through the delivery of an exercise program using outdoor multimodal exercise equipment (the Seniors Exercise Park) [15]. The Seniors Exercise Park integrates multimodal exercise stations that target balance (unstable/uneven surfaces), strength, flexibility and functional movements, designed for use by older people. The ENJOY project was based on our previous randomised controlled trial (RCT) which demonstrated the effectiveness of the Seniors Exercise Park program on improving physical function and social health in older people [16,17]. Building on the initial RCT, the ENJOY project was expanded into public community settings involving the installation of the specialised equipment in multiple communities. Participation in the ENJOY program resulted in various health benefits as well as sustained engagement in physical activity, perceived enjoyment and enhanced socialisation for older people [18,19]. The aim of this study was to investigate the impact of the Seniors Exercise Park program on falls (number of fallers and falls incidence) in older people.

METHODOLOGY

Design and Setting

This study was a multi-site prospective study with a pre-post intervention design and 12-month follow up. Main outcomes of the projects are reported elsewhere[18], the aim of the present study is to report the secondary outcome of falls. Participants underwent a 12-week structured supervised physical activity program using the Seniors Exercise Park, followed by a 6-month maintenance phase (unstructured program, including unsupervised access to the exercise park) with an overall 12 months participation from the time of enrolment to the study. The final study assessment occurred at this 12 months post enrolment timepoint. Supervised sessions were followed by a social gathering with morning/afternoon tea. The study was designed according to the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND)[20] which complements the widely adopted Consolidated Standards Of Reporting Trials (CONSORT) statement developed for randomized controlled trials [21]. Ethical approval was obtained from the Melbourne Health Human

Research Ethics Committee, (HREC/18/MH/286, local number 2018.238). All participants provided written informed consent. Full description of the methods, design, and procedure are in the trial protocol [15].

Study Population

Inclusion criteria

People were eligible to participate if they:

1) were aged ≥60 years living in the community; 2) had ≥1 fall in the previous 12 months or were concerned about having a fall; 3) were independent around the house (able to take care of themselves) and in the community (e.g. able to walk from home to visit local friends and local venues), and able to attend the outdoor exercise park; 4) were able to walk outdoors and use the exercise equipment with/without a single point stick; and 5) did not have cognitive impairment (Abbreviated Mental Test Score (AMTS) >7/10) [22].

Exclusion Criteria

Older adults were excluded if they: 1) had neurological or musculoskeletal conditions limiting walking to less than one block; 2) had a history of stroke, Parkinson's disease, or other neurological disorder impacting on mobility; 3) were unable to understand conversational English; 4) were taking part in a structured resistance training and/or an organised balance training program more than once a week; 5) met the Australian physical activity recommendations of 150 minutes of physical activity/week [23]; 6) had any medical condition or physical impairment that was deemed by their medical practitioner to contraindicate their inclusion.

Recruitment

Older people were recruited from the general community in suburbs close to the Senior Exercise Parks in Melbourne, Australia via advertisements in newspapers, council newsletters, social media, flyers displayed on notice boards, and distributed to senior groups.

The Seniors Exercise Park

The Seniors Exercise Park (Lark Industries (Australia) and Lappset Group) is a multigenerational outdoor playground equipment specifically designed for older people (Figure 1). It comprises multiple equipment stations that target a specific function or movement (upper and lower limb) such as shoulder range of movement, static and dynamic balance (unstable surfaces), functional movements (walking up/down stairs, sit to stand). Examples of the equipment stations and the exercises utilised in the ENJOY project can be found at https://youtu.be/PaYuCMtnlYk. The equipment was installed in two public locations and a third location in a retirement living and aged care community respectively: Barry Rd park, Thomastown, Melbourne (under the municipality of Whittlesea City Council); Central Community Centre Park, Hoppers Crossing Melbourne (under the municipality of Wyndham City Council); and Leith Park, St Helena Melbourne (Old Colonists' Association of Victoria).

Procedure

Details about the full study outcome measures and assessments are reported elsewhere [15]. Participants who met the inclusion criteria attended a baseline assessment at a community centre. Demographic characteristics (age, gender), anthropometric measures (height, weight) and falls history (number of falls experienced in the past 12 months) were collected at baseline. Record of retrospective falls was collected by asking the participant to advise if they have experienced any falls in the past year and if they did to then indicate how many of falls. Participants then had 9 months of access to the park, which included a 12-week supervised exercise program twice a week delivered by a qualified exercise instructor (Accredited Exercise Physiologist or Physiotherapist) and a 6 months maintenance phase. The 12-weeks supervised exercise program included twice weekly sessions approximately 60-75min duration. Each session consisted of 5-7 minutes of warm-up exercises, followed by 45-75 minutes at the equipment stations, and concluded with 5 minutes of cool down exercises. The exercise classes were run as a circuit-based group program with 6-10 participants and were progressive according to program progression, as detailed in the protocol paper [15]. In

the 6 month maintenance phase, participant could choose if to continue use the Seniors Exercise Park, either exercised at their preferred time (independent unsupervised access and usage of the exercise park) or during supervised time (twice weekly sessions at the exercise park under supervision, but with no formal structured group activity). The design follows the principle of falls prevention exercise programs, where a recommended dose of ≥50 hours is likely to achieve a positive effect on falls rates, which equates to approximately 2 hours a week for a 6-month period [24].

Falls surveillance

*F*alls were prospectively recorded for 12 months using calendars. Calendars were returned to the investigators each month via postage-paid mail. If a fall was recorded, or a calendar was not returned within three weeks after the end of any month, a researcher administered a standardised questionnaire via telephone to collect or clarify details of any falls (location, circumstances, injuries). Falls were defined as an event when the participant 'inadvertently comes to rest on the ground, floor or other lower level' [3].

Statistical Analysis

The proportion of fallers and falls incidence were compared between the preceding year and the prospective year using non parametric tests (Wilcoxon signed rank test). Descriptive information about the location of falls (inside or outside), circumstances for falling (if known) and any injuries that occurred are reported using descriptive statistics. The 12 months exercise and follow up period were divided into four quarters, with the falls reported as proportion within each quarter relative to the total number of falls.

RESULTS

Participants (n=95) had a mean age of 73.0 ± 7.4, with 82.1% female. The 12-week structured program was completed by 80. Interruption to data collection occurred during the COVID-19 pandemic due to physical distancing and lock down restrictions with participants unable to access

the equipment for several months (≥ 3 months). Follow-up data collection for n=19 was also impacted by COVID-19, and these were excluded from the analysis. In addition, four participants dropped out (one due to illness, two lost to follow up and one withdrawal). Data for 54 participants (age 72.4 ± 7.3, 79.6% women) who completed the whole study (with no COVID19 interruption) were available for the 12 months analysis (Table 1).

In the preceding year 51.8% (28) of participants reported ≥1 fall, with 42 falls events (0.77 falls rate). The number of fallers (n=17, 31.4%, p=0.03) and falls incidence (29 falls, 0.53 falls rate, p<0.01) were significantly reduced at the 12 months follow up. The number of multiple fallers (≥2 falls) between the preceding year (n=9, 32.1%) and the 12 months follow up (n=5, 29.4%) was not significantly different (p=0.1). The proportion of participants with one or more falls at each quarter is presented in Figure 2, with 37.9% of falls reported in quarter 1, reducing each quarter, to 13.7% reported in the last quarter. One fall occurred while exercising at the Seniors Exercise Park during a supervised session with no severe injury (the participant lost balance while taping on the platform). No serious adverse events (e.g., cardiorespiratory adverse reaction) occurred during the program [18].

DISCUSSION

The ENJOY project incorporated a physical and social activity program utilising innovative outdoor exercise equipment designed for older people. Participation in the Seniors Exercise Park physical and social activity program has been shown to result in health and physical benefits, promote sustained engagement in physical activity with enjoyment and increased socialisation [18,19]. The present study demonstrated that the Seniors Exercise Park may also reduce the risk of falls and falls incidence in at-risk older people. Half of the participants (51.8%) reported at least one fall in the preceding year which reduced to 31.4% in the subsequent 12 months, with the majority of falls reported due to trips and loss of balance. The falls rate following the intervention was reduced to be within the expected falls rate in older people in the community [1].

This program focused on functional daily movements, strength and functional balance, with progressive increase in difficulty and intensity. The equipment stations include unstable surfaces, and undulated platforms with the exercises designed to challenge balance during functional movements [15]. . Although our sample was too small to statistically compare the falls events between the four quarters, the incidence of falls show a trend of reduction from the beginning of the program (quarter 1) to later in the year. It is expected that benefits gained from improved strength and physical performance may take some time to impact on reducing the actual number of falls, where ongoing exercise is needed to maintain the falls prevention benefit of exercise [4]. The unique aspect of the ENJOY project was that the Seniors Exercise Park is freely available to be used by the public. In Victoria, Australia various local governments have incorporated outdoor exercise equipment (such as the Seniors Exercise Parks) in addition to the traditional children play spaces in their local public recreational spaces to be available for free community use. This enables ongoing usage and sustainability beyond completion of the project. In addition, the enjoyment reported and the socialisation aspect are also important factors to support long term adherence.

With the increase in the aging demographic, the need to create inclusive spaces for all ages is important, especially given the positive effect of well-designed physical outdoor environments have on promoting physical activity of older people [25,26]. . The ENJOY project aimed to fulfil the need for an age-friendly outdoor space for older people to enable participation in physical activity. The body of evidence generated around the physical and health benefits of these specialised Exercise Parks [16-19] and the collaborative approach utilised in designing and creating such age-friendly spaces may have important implications on how future recreational outdoor spaces can be better designed to also reduce the risk of falls for older people. The availability of such spaces in the community can also enable programs to be run by allied health professionals, community health centres and leisure centres; providing additional opportunities for physical activity programs to improve balance and strength. In addition, falls prevention programs that are offered by community health/health care providers are often limited in duration and capacity whereby after completion there are no available

alternative programs for older people to attend to maintain their physical health. The availability of recreational spaces with the Seniors Exercise Park can provide a suitable opportunity for continuation of falls prevention maintenance exercise.

The study has several limitations. Firstly, the study was impacted by COVID19 pandemic, with a portion of the participants being unable to continue exercising using this modality due to the lockdown. Consequently, we were unable to separate out the effect of the lockdown on activity levels and possibly falls, in the follow-up period. This has resulted in a smaller sample which may underestimate the impact of the program on falls. Secondly, our inclusion criteria requested that participants had experienced a fall in the past 12 months or were concerned about falling. In addition, retrospective recall of falls data may underestimate actual number of falls [27], which limits the likelihood of a study finding a reduction in falls if compared to a prospective approach to falls data collection after intervention commencement. Lastly, this study had an implementation pre-post research design and hence did not include a control group. Consequently, the effectiveness of the exercise program on reducing falls cannot be fully determined and will require investigation in a randomised trial. Despite these limitations, the outcomes reported provide preliminary evidence for the potential positive impact of the ENJOY Seniors Exercise Park on older people's falls risk.

Conclusion

The results suggest that the Seniors Exercise Park may be an effective program to reduce falls incidence in older people. Future work should be directed to examine the effectiveness of the Seniors Exercise park program on falls with a randomised control study design.

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References

1. AIHW. *Trends in hospitalised injury due to falls in older people 2007–08 to 2016–17.* Canberra: Australian Institute of Health and Welfare;2019.
2. ABS. *Population projections, Australia, 2017 (base)–2066.* Canberra: Australian Bureau of Statistics;2018.
3. WHO. *WHO global report on falls prevention in older age.* World Health Organisation;2007.
4. Sherrington C, Fairhall N, Wallbank G, et al. Exercise for preventing falls in older people living in the community: an abridged Cochrane systematic Review. *Br J Sports Med.* 2019.
5. Bull FC, Al-Ansari SS, Biddle S, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *Br J Sports Med.* 2020;54(24):1451-1462.
6. Sun F, Norman IJ, While AE. Physical activity in older people: a systematic review. *BMC Public Health.* 2013;13:449.
7. Milat AJ, Bauman A, Redman S. Narrative review of models and success factors for scaling up public health interventions. *Implement Sci.* 2015;10:113.
8. Jancey J, Lee A, Howat P, Clarke A, Wang K, Shilton T. Reducing attrition in physical activity programs for older adults. *J Aging Phys Act.* 2007;15(2):152-165.
9. McPhate L, Simek EM, Haines TP. Program-related factors are associated with adherence to group exercise interventions for the prevention of falls: a systematic review. *J Physiother.* 2013;59(2):81-92.
10. Li F, Eckstrom E, Harmer P, Fitzgerald K, Voit J, Cameron KA. Exercise and Fall Prevention: Narrowing the Research-to-Practice Gap and Enhancing Integration of Clinical and Community Practice. *Journal of the American Geriatrics Society.* 2016;64(2):425-431.
11. Cohen DA, Marsh T, Williamson S, Golinelli D, McKenzie TL. Impact and cost-effectiveness of family Fitness Zones: a natural experiment in urban public parks. *Health Place.* 2012;18(1):39-45.

12. Cohen DA, Marsh T, Williamson S, et al. The potential for pocket parks to increase physical activity. *Am J Health Promot.* 2014;28(3 Suppl):S19-26.

13. Lee JLC, Lo TLT, Ho RTH. Understanding Outdoor Gyms in Public Open Spaces: A Systematic Review and Integrative Synthesis of Qualitative and Quantitative Evidence. *Int J Environ Res Public Health.* 2018;15(4).

14. Levinger P, Panisset M, Parker H, Batchelor F, Tye M, Hill KD. Guidance about age-friendly outdoor exercise equipment and associated strategies to maximise usability for older people. *Health Promot J Austr.* 2020.

15. Levinger P, Panisset M, Dunn J, et al. Exercise interveNtion outdoor proJect in the cOmmunitY for older people - the ENJOY Senior Exercise Park project translation research protocol. *BMC Public Health.* 2019;19(1):933.

16. Sales M, Polman R, Hill K, Levinger P. Older adults' perceptions to a novel outdoor exercise initiative: a qualitative analysis. *J Aging Soc Change.* 2018;8 (1):61-78.

17. Sales M, Polman R, Hill KD, Levinger P. A Novel Exercise Initiative for Seniors to Improve Balance and Physical Function. *Journal of Aging and Health.* 2017;29(8):1424.

18. Levinger P, Panisset M, Dunn J, et al. Exercise interveNtion outdoor proJect in the cOmmunitY for older people – Results from the ENJOY Senior Exercise Park project translation research in the community *BMC Geriatric.* 2020(20):446.

19. Levinger P, Dunn J, Panisset M, et al. The ENJOY project – usage and factors to support adherence and physical activity participation. *Translational Journal of the American College of Sports Medicine.* 2021;6 (3):1-6.

20. Des Jarlais DC, Lyles C, Crepaz N, Group T. Improving the reporting quality of nonrandomized evaluations of behavioral and public health interventions: the TREND statement. *Am J Public Health.* 2004;94(3):361-366.

21. Schulz KF, Altman DG, Moher D. CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. *BMC medicine.* 2010;8(1):18.

22. Hodkinson HM. Evaluation of a mental test score for assessment of mental impairment in the elderly. *Age Ageing.* 1972;1(4):233-238.

23. Sims J, Hill K, Hunt S, Haralambous B. Physical activity recommendations for older Australians. *Australas J Ageing.* 2010;29(2):81-87.

24. Sherrington C, Tiedemann A, Fairhall N, Close JC, Lord SR. Exercise to prevent falls in older adults: an updated meta-analysis and best practice recommendations. *N S W Public Health Bull.* 2011;22(3-4):78-83.

25. Hooper P, Foster S, Edwards N, et al. Positive HABITATS for physical activity: Examining use of parks and its contribution to physical activity levels in mid-to older-aged adults. *Health Place.* 2020;63:102308.

26. Moran M, Van Cauwenberg J, Hercky-Linnewiel R, Cerin E, Deforche B, Plaut P. Understanding the relationships between the physical environment and physical activity in older adults: a systematic review of qualitative studies. *Int J Behav Nutr Phys Act.* 2014;11:79.

27. Hill K, Schwarz J, Flicker L, Carroll S. Falls among healthy, community-dwelling, older women: a prospective study of frequency, circumstances, consequences and prediction accuracy. *Aust N Z J Public Health.* 1999;23(1):41-48.

Table 1: Participants' demographic characteristics

Measures	Participants n=54
Age (yrs), mean ± SD	72.4 ± 7.3
Females (%)	43 (79.6)
Height (m), mean ± SD	1.6 ± 0.1
Weight (kg), mean ± SD	75.9 ± 15.7
BMI (kg/m²), mean ± SD	29.2 ± 5.4
Fallers in preceding 12 months (%)	28 (51.8)
Multiple fallers (≥2 falls) in preceding 12 months (%)	9 (32.1)
Falls number in preceding 12 months	42
Fallers in prospective 12 months (%)*	17 (31.4)
Multiple fallers (≥2 falls) in preceding 12 months (%)	5 (29.4%)
Falls number in prospective 12 months ǂ	29
Circumstances of prospective falls	
Location Indoor (%) Outdoor (%)	 13 (44.8) 16 (55.2)
Circumstances of falls Trip Loss of balance Slip Unsure	 11 (37.9) 6 (20.6) 5 (17.2) 3 (10.3)

Heat stroke Rolled ankle Foot got stuck	1 (3.4) 2 (6.8) 1 (3.4)
Injuries associated with any of the falls	17 (58.6)
Type of injuries:[#] Bruises/ Soreness Grazing Laceration Needed medical attention GP check-up with no follow-up treatment needed	 10 (58.9) 6 (35.2) 1 (5.9) 1 (5.9) 2 (11.7)

*Significant difference p = 0.03 ǂ Significant difference p < 0.01

[#] Participants could report more than one injury, so percentages add up to >100%

Figure legends

Figure 1: The Seniors Exercise Park at Hoppers Crossing, Melbourne

Figure 2: The proportion of falls across the four quarters of the 12 months period.