Feasibility and acceptability of orientation and mobility instructors delivering the LiFE falls prevention program to older people with vision impairment.

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Older people with vision impairment are at an increased risk of falls. Though exercise-based intervention can reduce falls in the general population, this strategy has not been successful among people with vision impairment. We evaluated the feasibility and acceptability of the LiFE program, a home-based fall prevention program, for people aged over 50 with vision impairment (n=16). The program was successfully delivered by orientation and mobility instructors to clients of Guide Dogs NSW/ACT, a community service organisation. Interviews with study participants showed engagement and adherence and there were positive trends in physical outcome measures supporting this program as a promising approach to enhance strength and balance, ultimately reducing the likelihood of falls in older people with vision impairment.

Introduction

It is estimated that one in three older Australians fall each year (Tinetti, Speechley, & Ginter, 1988). Falls can result in major injury and are the leading cause of hip fracture. Further, falling often lead to loss of confidence, nursing home admission, and can precipitate a rapid decline in health status (Ivers, Cumming, Mitchell, Simpson, & Peduto, 2003; Ivers, Norton, Cumming, Butler, & Campbell, 2000; Patino, McKean-Cowdin, Azen, Allison, Choudhury, & Varma, 2009; Tinetti & Williams, 1998). Older people with vision impairment are up to eight times more likely to fall than those with normal vision (Ivers, Cumming, Mitchell, Simpson, & Peduto, 2003; Ivers, Norton, Cumming, Butler, & Campbell, 2000; Patino, McKean-Cowdin, Azen, Allison, Choudhury, & Varma, 2009; Tinetti & Williams, 1998). With falls currently costing society 1 billion dollars each year and the rising numbers of older people with vision loss (Taylor & Keeffe, 2005) there is a pressing need to address falls risk among older Australians with vision impairment.

Strength and balance training has been established as an effective intervention to reduce falls risk in the general population (Sherrington, Tiedemann, Fairhall, Close, & Lord, 2011) and older people with poor vision are less active (Ramulu, Maul, Hochberg, Chan, Ferrucci, & Friedman, 2012) and have worse balance than older people with normal vision (Black, Wood, Lovie-Kitchin, & Newman, 2008). An epidemiologic study that investigated the factors which explain falls risk in older people with low vision found physical inactivity was one of the strongest indicators of falls risk, increasing the likelihood of falling by three times (Lamoureux, Gadgil, Pesudovs, et al., 2010). Another population-based study demonstrated that it was the combined effects of vision loss and poor balance that best explained falls risk in older people with vision loss (Kulmala, Viljanen, Sipila, et al., 2008). These findings lend support for fall prevention interventions which seek to improve the balance and strength. An effective intervention might not only reduce falls, but enhance the independence and quality of life amongst this high risk population.

A recent systematic review found that there are few trials evaluating exercise based falls prevention strategies for older people with vision impairment (Gleeson, Keay, & Sherrington, 2014). Specifically there was evidence from four trials in residential aged care settings which demonstrated that physical function can be improved. The one large community-based trial, which evaluated the Otago Programme in older people with vision impairment, did not find any reduction in the rate of falls (IRR 1.15, 95% CI 0.82-1.61) (Campbell, Robertson, La Grow et al., 2005). The authors explained this finding as a result of low levels of adherence to the program but it is also possible that the walking activities which are part of the Otago Programme may have exposed participants with vision loss to unanticipated risk. A recent study evaluated the Alexander Technique as a novel form of physical re-education to improve physical function and thereby reduce falls in a population of older people living in the community with vision impairment (Gleeson, Sherrington, Borkowski, & Keay, 2013). The trial evaluating this intervention involved 120 people and produced promising results, though the trial was not sufficiently powered to measure a reduction in falls (IRR = 0.61, 95% CI 0.28 to 1.30) (Gleeson, Sherrington, Lo, & Keay, 2014). These recent results suggest that it is possible to improve physical function and reduce falls for older people with vision impairment, living in the community.

The Lifestyle Integrated Functional Exercise (LiFE) program is a strength and balance training program which has been specifically designed for high risk populations and is a potentially scalable falls prevention program for older people with vision impairment living in the community. This program has been shown to reduce in falls by 31% (IRR=0.69, 95% CI 0.48-0.99), compared to the control, and also demonstrated improved confidence, independence, and ability to complete daily tasks among the participants (Clemson, Fiatarone Singh, Bundy et al., 2012). This program has not been evaluated in a population with vision impairment.

Our aim was to determine whether or not the LiFE program could be adapted and delivered to older people with vision impairment through a community service

organisation (Guide Dogs NSW/ACT) by orientation and mobility (O&M) instructors and to estimate the likely benefits for physical function.

Method

We used a mixed methods approach to evaluate delivery of the LiFE program as a falls prevention initiative to older people with vision impairment via a community organisation providing O&M services (Guide Dogs NSW/ACT). The LiFE program was adapted for this target population before evaluation in this pilot study. The feasibility and acceptability of the LiFE program were assessed from the perspective of both the program participants and the O&M instructors who were trained to deliver to program. We measured physical performance including the short physical performance battery (Guralnik, Ferrucci, Pieper, et al., 2000) and administered the Late-Life Function and Disability Instrument (LLFDI) (Sayers, Jette, Haley, Heeren, Guralnik, & Fielding, 2004) before and after the program as an indicator of any likely benefits for function. This study was approved by the University of Sydney Human Research Ethics Committee and written informed consent was gained from all study participants.

Study participants

We sought to recruit up to 20 participants from the client database of Guide Dogs NSW/ACT. To be eligible to participate in the study potential participants must have had a vision impairment that, in the past five years, had required an O&M program. Additional inclusion criteria also required participants to be aged over 50, have a competent level of English to undertake the activities, have a history of falls or have a fear of falls and be able to walk independently (long canes or other O&M aids were permitted).

LiFE program

The LiFE program was delivered through approximately seven sessions over a 12 week period with a follow-up phone call at five months after the commencement of the program. The Lifestyle-Integrated Functional Exercise (LiFE) program is a tailored approach using a series of balance and strength activities that are embedded in daily routines and tasks to prevent falls (Clemson, Fiatarone Singh, Bundy et al., 2012). The LiFE program involves teaching core underlying principles of balance and strength training that involve: decreasing base of support, leaning sideways, bending knees, standing/walking on heels or toes, walking sideways, moving from a seated to standing position, and tightening and relaxing lower limbs. Participants were taught the seven balance and eight strength activities within their own home by health practitioners trained in the LiFE program, in this case O&M instructors. Rather than prescribing a set number of exercises to complete each day or week, the LiFE program uses habit formation, incorporating these activities into the daily routines of participants. Lally and Gardner (2011) argued that habit formation is largely dependent on repetitive behaviour conducted in a consistent environment. By conducting the LiFE program in the home, the participants are taught to think about their own surroundings as opportunities to incorporate the activities. Similarly, the daily routines that these activities are embedded in, become the 'cue' that participants require

to perform each activity (Lally & Gardner, 2011). The LiFE program is also structured in such a way that participants can continue to challenge their balance and strength by 'loading the muscles' or by reducing the base of support (Clemson, Fiatarone Singh, Bundy et al., 2012).

Qualitative data: Acceptability and feasibility of the program

We adapted a published interview schedule (Yardley, Dennison, Coker et al., 2010) which was used to elicit beliefs relating to each construct of the theory of planned behaviour (Godin & Kok, 1996). These semi-structured interviews were conducted over the telephone with the participants two weeks after commencing the program as both formative and summative evaluation. A second interview was conducted after completing the program and covered general impressions of the program, unexpected outcomes, and whether or not the program would be recommended. The questions probed the attitudes and intentions of the pilot study participants, having had experience with the LiFE program. The program delivery was adapted in response to feedback about these interviews.

An on-line questionnaire including open questions was used to canvas the views of the instructors. These were completed by the four participating O&M instructors after they had delivered the program. Questions sought to gain insight about further modifications of the program that might be required to suit the needs of the participants with vision impairment as well as the appropriateness of the balance and strength activities for this population.

We used content analysis (Elso & Kyngas, 2008) to interpret the transcribed interview data and text from the participant and instructor surveys. A conventional approach, described by Hsieh and Shannon (2005), was taken to allow codes and categories to emerge from the data. Two investigators reviewed the data independently before coming to agreement on its interpretation. Responses to the second set of interviews were quantified in terms of the physical outcomes, impact on daily life, whether the program would be recommended, perspectives of the program and intent to continue with the program.

Quantitative data: Physical function measures and Late Life Function and Disability Index

Balance and mobility were assessed using the timed Short Physical Performance Battery (SPPB) which includes three mobility tasks: sit-to-stand five times, standing balance time for three foot positions, and gait speed over four metres (Guralnik, Simonsick, Ferrucci et al., 1994). Other measurement tools included the Short-Falls Efficacy Scale which is a measure of fear of falling (Kempen, Yardley, van Haastregt et al., 2008) and the Late-Life Function and Disability Instrument (Sayers, Jette, Haley, Heeren, Guralnik, & Fielding, 2004) . Each of these measures was administered at baseline and after the program completion. This was a pilot study, had no control group, and was not designed to measure a difference in outcome measures but rather to give an indication of the applicability of these measures within this population (Leon, Davis, & Kraemer, 2011).

Results

Sixteen participants were recruited into this pilot study but one participant discontinued the program after enrolment due to lack of interest. The age of the participants ranged between 52 and 93 with an average age of 70 years (Table 1). Women were overrepresented in this study with only one male completing the program. The main conditions causing sight loss were glaucoma (3), retinitis pigmentosa (4), age-related macular degeneration (3), and other or multiple eye conditions (6). These included glaucoma (2), loss/damage of an eye (2), Stargardts disease (1), cone dystrophy (1), gyrate atrophy (1), Cystoid Macular oedema (1), stroke (1), and hemianopia (1). The study participants were living in the community and used mobility aids. Falls were prevalent and their body mass index was on average in the overweight range. The full LiFE program was delivered to 15/16 participants.

Qualitative data: Acceptability and feasibility of the program

Participant interviews

A total of 12 interviews were completed in the first few weeks of the program and 13 interviews after the program, as not all participants were able to be contacted by phone.

Participants spoke of challenges to using the participant manual and recording their activities: '*There needs to be an easier way of recording especially when you have multiple pieces of paper to use'* HB 87 years and '*Everything you do as a blind person is hard'* CD 71 years. The LiFE program manual in its original format was delivered to all participants. However, other forms of the manual were also made available including an audio recording, large print, and electronic text suitable for use with a screen reader. The manual was still considered overly long by some participants but others reported enjoying the content, for example the testimonials '*Enjoyed reading the stories about others and seeing what they can do*' KM 56 years.

There were positive responses to delivery through their familiar O&M instructor '*I'm working with my instructor to work within [my] limits'* LM 55 years,' *the instructor coming each week and going through it is very helpful'* RM 58 years and' *a visit from the Guide Dogs instructor each week helps'* HB 87 years.

Table 1. Characteristics of the study population.

Age	**70±15 (range 51-92)**
Gender	1 males, 14 females
Education	6 (year 10), 2 (year 12), 8 (higher)
Housing	8 home, 3 independent living unit, 5 unit
Live alone	11/16 (69%)
Mobility aids	12 long cane, 5 mini-guide, 2 guide dogs, 3 support cane
Falls	13/16 had fallen in last year (1 fracture)
BMI	29.9±8.5 (range 18-45): 4 overweight, 7 obese

The first round of interviews data were also coded against behavioural, normative, and control beliefs in line with the theory of planned behaviour. The behavioural beliefs relating to the program were that there would be benefits for health, balance, and strength was a new initiative but mixed concerns about being able or interested to do the exercises. One participant clearly stated the benefits were *'to improve balance…… for safety and security, particularly after the falls that I have had'* AB 54 years. A number cited that it was an advantage that you could integrate the exercises into everyday activity '*But it's good in that you don't have to do anything extra'* HB 87 years old.

When prompted about normative beliefs, most were surprised and felt they made their own decisions about what is appropriate. The few that had sought opinions of friends and family had received support. The overall impression was that this program was suitable for people with vision impairment.

Within the construct of control beliefs, there were sentiments of self-efficacy and the importance of maintaining independence: *'I've tried to help myself all along, trying to maintain independence*' FK 88 years. Several reported a learning experience *'At first I was confused'* RM 58 years and *'I had difficulty coordinating feet, heels, and toes at first but as I did them I got better'* DR 65 years. The program also challenged their balance often forcing participants outside of their comfort zone: '*trying to incorporate the leaning exercise, I don't know if it's a mental thing or personality but it's quite difficult'* DR 65 years and *'I can see already my bad balance, and the balance activities are the hardest things'* HB 87 years. Additionally, comments were also made about the ability to alter their routines to accommodate the activities and the sustainability of the activities once the program was completed, including financial constraints.

The second round of interviews which occurred after participation in the LiFE program revealed a generally positive response to the program. Positive aspects identified included the program's delivery via O&M instructors and the programs focus on physical technique when performing the exercises.

At program completion, most participants indicated that the program was relatively easy to undertake *'Quite easy and enjoyable'* HB 87 years and could see the benefits of physical training '*Use it or lose it*.' MC 75 years. In particular, multiple participants noted that following the program, there was greater ease performing daily tasks such as when walking up stairs, not leaning on a table to rise from a chair '*Can get up and down off the seat a bit better*' LM 55 years, '*can go up stairs better. Improved my confidence in maintaining balance and increased my flexibility especially in feet and legs most of all*' KM 56 years and '*I did notice that going up stairs that my legs felt stronger*' FK 88years. One participant took this message further, '*I'm less likely to trip because they taught me proper stepping*' KM 56 years.

Pre-existing co-morbidities were identified as a factor preventing complete participation in the program as well as ongoing problems associated with vision impairment: '*Some of the exercises a bit difficult because of reduced vision'* FK 88 years. Participants who were already involved in additional exercise activities, such as attending the gym, reported less improvements to balance or strength.

Not all responses were positive and negative viewpoints included candid dislike of the exercises '*it's just quite a tedious exercise'* and '*Found some of it to be a bit of a chore'* AB 55 years.

The responses to physical outcomes, impact on daily life, recommendation to others, and likelihood of continuing in the program are quantified in Table 2. The majority cited benefits and improvements to activities of daily living; would recommend the program to others; and showed some intention to continue with the program.

Feedback from O&M Instructors

Feedback from the O&M instructors indicated that most of the activities were easy to teach and that the participants understood the way to do the activities. However, certain activities proved problematic for some of the participants, in either teaching the activity, or being able to complete the activity. The stepping in different directions activity was not used by any of the instructors. The balance activity of leaning side to side was also indicated as an activity that was either difficult to teach to participants (4) or was not used to all (4). The leaning forwards and backwards was reported as the most uncomfortable activity for participants due to a greater sensation of falling and sense of vulnerability caused by their vision impairment and this is reflected in the participant interviews. This activity was difficult to teach to four of the participants and was not used for one. However, for the remaining participants it was indicated as

Table 2. Outcomes from Post-Intervention Interview (n=13).

Reported Physical Outcomes
Improvement to balance and strength (10)
Strength only (1)
Balance only (2)
No improvement (3)
Due to comorbidity (1)
Impact on Daily Life
Positive improvements to conducting daily activities (9)
No impact on daily activities (2)
Recommend to others
Would recommend program to others that are vision impaired (12)
Would not recommend to others (1)
Perspectives Towards the program
Easy to understand and complete activities (9)
Not enjoyable to complete activities (2)
Increase length of time that the activities are delivered over (2)
Continuation of the Program
Will continue activities (10)
Not all of the activities will be continued (3)
Comorbidity currently preventing continuation (2)
Will not continue (1)

an activity that was easy to teach (7) or was neither difficult nor easy to teach (3).

The 'up the stairs' activity was not used by six participants as they did not have stairs in the homes; and for two participants fear of falling or other mobility restrictions resulted in this activity not being used during the program. However, the remaining balance and strength activities were consistently indicated as activities that were easy to teach, and well understood by the participants.

The instructors found insufficient time for participants to be successfully taught and to master the activities and recommended that the number of sessions should be increased. In addition to modifying the activities for the participants, the O&M instructors also worked with their participants and their varying levels of vision impairment to develop effective ways of recording the daily and weekly completion of the activities. For recording activities participants used a range of methods from the standard written record, a large print format , voice recording, a box with counter, and one instructor also used email for the participant to make the record electronically.

Quantitative Measures

While this small study was not powered to measure differences in outcome measures and did not have a control group for comparison, there was an indication of possible improvements for physical function, reduction in fear of falling, and less difficulty with tasks of daily living (Table 3). No changes were seen in standing balance or the timed four metre walk. The outcome measures were found to be applicable to this population.

Discussion

We report on the adaptation and implementation of the LiFE program (Clemson, Sherrington, Lo, & Keay, 2014) as a falls prevention strategy for older people with vision impairment. This is the first time that the LiFE program has been delivered specifically to a population with vision impairment. The response to the program was generally positive, was

Table 3. Changes in physical function after completing LiFE program paired t-test *(n=15)*.

All data means±standard deviations	Before program	After program	P value
Standing balance (total seconds)	48.1±9.9	51.9±11.2	0.38
Timed sit-to-stand	17.5±8.1	16.1±6.8	0.24
Timed 4 metre walk	6.4±3.5	5.2±1.6	0.16
Fear of falling (Short FES-I), 0-28	13.7±5.1	11.2±4.9	**0.04**
LLDFI-part 1	75±19	69±19	**0.03**
LLDFI-part 2	62±10	62±12	0.88

Note: Longer times for standing balance, shorter times for timed tests indicate better function, higher score on the SFES-I greater fear of falling and higher scores on LLDFI indicate more disability. Bold p values are statistically significant.

completed by 15/16 of those enrolled, would be 'recommended to others' and the majority (>90%) planned to continue to performing LiFE activities.

Dose is critical to the success of a strength and balance training falls prevention program, with recommendations that a program should provide a moderate or high challenge to balance and be undertaken for at least two hours per week on an ongoing basis (Sherrington, Tiedemann, Fairhall, Close, & Lord, 2011). The only large scale trial in a population with vision impairment which evaluated the impact of strength and balance training using the Otago Exercise Programme did not find a reduction in falls (Campbell, Robertson, La Grow et al., 2005). The authors attributed this result to low uptake of the exercise program. In this study just 19% (37/195) of participants completed the recommended three or more sessions per week, compared to previous reports of compliance of 43% in the general community (Robertson, Devlin, Gardner, & Campbell, 2001). It is possible that the LiFE program and its mode of delivery will offer a solution to the low rates of compliance previously reported with people with vision impairment, though this would need to be confirmed in a large trial.

The delivery of this program by O&M instructors was well received by our group. This positive response may be associated with the fact that the participants were familiar with the organisation or both the instructor and the organisation and, therefore, had a pre-existing relationship and trust to work together on this program. Though barriers relating to comorbidities and limitations of poor vision were raised, it seems that there was learning and uptake of the program. The instructors also demonstrated the ability to adequately tailor this program to individual needs, thus enhancing continued performance of the LiFE program activities.

In light of the feedback from the instructors and the participants, further adaptations of specific activities and recording systems need to be made to suit a variety of levels of visual acuity or blindness. Future applications of this program in this population would need similar additional materials, including large print, audio files, and electronic format. We also recommend allowing for additional sessions to deliver the LiFE program to people with vision impairment.

Yardley surmised that the intention to participate in strength and balance training is more related to elements of coping appraisal rather than threat appraisal (Yardley, Bishop, Beyer et al., 2006; Yardley, Donovan-Hall, Francis, & Todd, 2007). Such considerations include benefits of the program, positive social identity, and belief that family, friends, and doctors would approve of the activity. We also found that the perceived benefits to the participating in the program were improvements in physical functional performance. However, a number of participants did refer to their concerns about falling and sought to reduce their risk.

In summary, the LiFE program was successfully delivered to this high-risk population. While these results should be interpreted with caution as there was no control group, nor was the study powered to measure differences in outcomes measures, the results indicate that this could be a

promising approach for future home-based falls prevention interventions.

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